The Chemical Age

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Notes and Comments

Things That Count

THE little things that count, and weigh and measure and control, are oftentimes more important than the big imposing pieces of plant that bulk so largely in the eye of the casual observer. It is for that reason that we periodically devote an issue specifically to the description and discussion of plant accessories. It is sometimes difficult to determine where the plant accessory commences and the laboratory apparatus finishes. Many plant accessories are best described as comparatively robust examples of laboratory apparatus applied to the practical purpose of plant control. Thermocouples, whether for spot readings or of the recording variety, come under this heading; on the other hand, automatic weighing apparatus that perhaps tells the works superintendent how many hundreds of tons of a given material have passed that way during the day, though equally a plant accessory, cannot be termed " laboratory " by any stretch of the imagination. The plant accessory may not necessarily deal with the mechanical or inert side of the works. An air-conditioning plant which will render the workers better able to perform their tasks may equally be a plant accessory. The works fire-engine and the chemical fire-fighting installation are equally necessary, though exerting no influence upon the processes employed. Daily, weekly or monthly all well-regulated works have a minor stocktaking to ascertain makes of product, raw materials in stock and so forth. At such times, tanks gauges, distance indicators and the like are worth their weight in gold. Frequently it is necessary to measure liquids, solids and gases whilst in use, sometimes for the purpose of correctly charging an apparatus for a reaction, sometimes merely to know what quantities have been used; the meters that are available for these purposes are many and varied. Some plant accessories are essential to the proper functioning of the apparatus; of this type one need only mention pressure gauges, blow-off valves, steam traps, pipe-cleaners and syphons.

There are, in short, a host of plant accessories, some of which are essential to the functioning of apparatus and can only be neglected at peril of life or profit; there are others which do not appear to exert any influence upon the process or plant, but which control the flow of materials to a nicety and remove some part of that human factor from the process that is so apt to fail periodically. There is yet another type of accessory that to the less efficient appears the least valuable of all, and that is the recording apparatus which to the initiated tells the story of what has been happening to the plant continuously through the day. There are many who demur at the cost of these accessories, but there can be no question that they repay handsomely the money expended upon them by economies that do not appear specifically in the balance sheet, but that are none the less real when the annual profit and loss account comes to be made up. The chemical works manager will neglect plant accessories at his peril.

The Science Library

COMPARATIVELY few people have any idea of the importance of the Science Library, now attached to the Science Museum at South Kensington, which has gradually gathered together a comprehensive collection of English and foreign publications on science and technology from the earliest times. It has been estimated that about three-quarters of a million important scientific and technical papers are published annually in about fourteen thousand periodicals, while the more important separate books published in these subjects number also about fourteen thousand in a year. Of these the library acquires some eight thousand current periodicals together with a selection of the more important works, bringing its total annual accessions to upwards of forty thousand volumes and parts. The Federation of British Industries, in its "Fuel Economy Review," has rendered a useful service in drawing attention to some of the features of the library. It points out that one of the great difficulties in gathering together an entire collection of the literature of a subject is to know what publications exist; in this respect little help may be had from technical experts, whose sources of information comprise the books they possess or have seen in libraries, together with advance notices of the very small fraction of published literature that reaches them. In each country there are, however, certain bibliographies which contain fairly complete lists of the books as they come out. As few of these bibliographies are classified, they must be read through in order to select the books on a particular subject. By marking two copies of these bibliographies for each country, some fifteen publications in all, and mounting the selected items on cards, a tolerably complete list is made of all the scientific and technical books published in the world. After book selection, the cards form a cumulative catalogue of all books on pure and applied science. For notices of new periodicals, the current numbers of existing periodicals have to be searched as they appear. Titles so obtained are added to the list of books. Altogether a considerable organisation is needed for this preliminary survey, and it is

clearly impossible for any but the largest libraries to undertake it. With the aid of the information so acquired, the Science Library has been able to build up very extensive specialist collections of literature on all branches of pure and applied science.

The literature having been acquired must be made available to the student, and the only means to this end is the provision of a complete index to the records of original work and thought. The compilation of such an index is being attempted in the Science Library. Although the number of papers to be indexed is far beyond the powers of any library as yet constituted, a great many bibliographical publications have been issued from time to time, often in periodical form, which contain lists of papers on different subjects. As many as possible of these bibliographies have been collected in the library and it has been estimated that these contain altogether some forty million references. Most of the sources of bibliographical information are either entirely without system or are arranged according to a multiplicity of systems, such that they cannot be brought together and each source must be searched separately. Thus the time involved is increased to a maximum, perhaps reaching several weeks. Although the number of abstracts and bibliographical references published is equal to the number of scientific and technical papers to be indexed, there is so much overlapping that only one-third of the important papers is indexed and two-thirds are missed.

A Standard Bibliographical System

WE agree with the writer of the article in the " Fuel Economy Review " that the one practical solution of the difficulties associated with the compilation of a complete index such as is needed at the Science Library is the general adoption of a standard bibliographical system, such as the Universal Decimal Classification, the new edition of which is so minutely subdivided as to contain a place for almost every concept that has been, or is likely to become, the subject of scientific or technical discussion. There is a permanent Commission of the Classification at the Hague, which is ready to issue new extensions as they are required. In using this classification, each abstract, or title of a paper, is given the decimal number or numbers, which indicate its subject matter. Thus all bibliographies compiled according to the standard system can be brought together into one series, where references to a particular subject are collected in one place under its classification number. As the number corresponding to a specific subject can be ascertained at once from the index to the classification, all the references to a given topic can be located in a moment. The use of the classification is now extending rapidly as it is becoming more widely known and its great value appreciated. More than forty bibliographical organisations in this country alone have adopted the scheme during the last few years.

In the Science Library all the bibliographies that are classified by the Universal Decimal Classification are amalgamated into one great card index which is growing at the rate of one hundred and fifty thousand entries a year, having now reached two million cards or one and a half times the size of the International Catalogue of Scientific Literature. This index, together with the collection of miscellaneous bibliographies, constitute the library information service, by means of which readers or inquirers may ascertain what literature on a particular subject is available. In order that the widest use of the books in the library may be made, books are lent to approved institutions at which scientific research is carried out. The Science Library lends its books to the teaching staff and research students of the Imperial College of Science and Technology, to officers of Government departments, to research workers through the medium of research institutions, scientific societies and universities to which they belong, and through the National Central Library to the general public.

Subdividing Gaseous Streams

IT sometimes happens in the course of chemical processes that a stream of gas in which is contained suspended solids is to be divided into two or more smaller streams, each uniform in composition with the parent stream. The difficulties of doing this are patent if only because the parent stream is not likely to contain the same concentration of solids throughout its cross-sectional area. The heavier solids will tend to drop to the bottom and where the speed of the current against the pipe is least the concentration of solids may be a minimum. Many chemical engineers have visited the Shipping, Engineering and Machinery Exhibition at Olympia, but possibly few of them noticed the very ingenious little device invented by the Fuel Research Board for solving this problem. The method was in the first place applied to the subdivision into two or more streams of an air-powdered fuel mixture, the streams being fed to a number of pulverised-fuel boilers. It is clearly essential in such cases that each boiler should receive its proper share of the total air-fuel mixture and also that the ratio of fuel to air—*i.e.*, of solid to gas—should be the same for each boiler. The principle could, of course, be applied to all similar cases of solid-gas streams. Equally, the device might be applied to sampling such a heterogeneous mixture while in motion along a pipe.

The method consists of the subdivision of the pipe into the requisite number of streams by an inserted piece of apparatus. The secret lies in the design of the apparatus. This consists of a short " honeycombed " fitting completely filling the pipe, the honeycombing consisting of a number of passages, square in section that pass in a straight line through the fitting, in the general direction of, but not parallel to, the pipe. Supposing the stream is to be divided into two equal parts, the section of the fitting into which the gas enters has the appearance of a draught-board, the squares representing the passages. Clearly the total area is exactly subdivided into two equal portions, half of black squares and half of white squares. When the passages connected to each of the squares are properly inclined, it is possible without interrupting the continuity of the " honeycomb " to arrange that the passages connected with white squares shall at the outlet end lie in a series of straight lines and similarly the black passages shall lie in straight lines. It is then only necessary to connect the parallel passages by ducts for the white squares to be collected together and all the gases that enter the white squares pass into a common pipe; similarly, of course, for the " black " passages.

The British Association Meeting, 1935

Some More Reflections by Professor H. E. Armstrong

THE broth provided, at Norwich, by the senior chef, his thirteen cooks and several tweenies, was inevitably spoilt by the proverbial too many. Proof of this is to be found in the Press, which took but scant notice of the proceedings. The Association now has only local value: the published addresses fall into few hands. We can no longer pretend that the preceedings are of service in promoting the advancement of knowledge, even among its votaries: only hashed mutton is provided; everything brought forward is already known, in these days of forestalled publication in the weekly press. The meetings are but poorly attended by the profession and very few foreigners are present. In fact, in these locomotory times, scientific workers indulge in so much joy-riding to conferences on every possible and impossible subject that no gilt is left for the Association gingerbread, which can now only be wrapped in tin-foil, like poor cheese and chocolate. There are no real "lions" to show. The social value of the meetings is reduced to a minimum. The discussions are staged, a few performing companies being trotted out for the purpose. Thus in Section A, Lord Rutherford assembled his "sisters and his cousins and his aunts" from Cambridge, to discuss before an autograph seeking audience transcendental work that was being done—mainly at Cambridge. Why leave the Cam for the Broads? In B, Brumagem chemists discussed Brumagem chemistry—the very best of its kind but of entirely special interest.

It is to be feared that the president showed little sense of humour when speaking to representatives of the Press on the closing day. He was clearly thinking only in terms of the past and without considering elementary social needs of the day. The geological problem of the Great Rift Valley, to which he referred as a subject of importance brought before the meeting, is no concern of the public—what does concern us is the fight that is likely to take place—the Rift of the Nations—for its possession and the misuse of scientific mechanism this will involve. Not a few of us feel that the main effect of the Advancement of Science, in recent times, has been to set the nations by the ears: to cause them to use machinery mainly to their mutual disadvantage. New stars and new elements afford no solution to our overwhelming social problems. The president showed only too clearly that there is no official appreciation, within the Association, of the gravity of the situation.

The Presidential Address

The presidential address was a masterly discussion, in the main, of the surface form of our earth, the more pleasing as it is written in lucid English, almost in words of one syllable, so setting a much needed example. Those who can read it with understanding must be struck by the way in which the stone breakers are being led to adopt the method which the Association so fails to use: to bring the sciences together in discussing their major problems. The geologist is no longer a mere map and hammer man but something of everything. He is turned topsy turvey and forced to stand upon his head by the discovery of radium and radio-activity. His estimate of earth-age is therby greatly increased and he is forced to think of our globe heing hotted up at least in cycles instead of as always cooling down. A Joly shows not only how radio-activity draws circles in rocks but how it may have caused land and sea to vary in place and be as they are.

Professor Watts took as his chief theme the hypothesis, still far from a theory, set out by Wegner, that the great continents were once continuous and have gradually floated apart. However interesting it may be to think that the opposite sides of the Atlantic were once joined together, I doubt if a single Englishman now wishes to come into a "close-up" with the States—we have sufficient difficulties of our own to settle and are in no way enamoured of the result of the Pilgrim Fathers attempts at founding a civilisation: the ruthless waste of natural resources is too appalling, whatever the efficiency of their industrial activity. This brings me to my point. The world is no better today for discussing the form of the earth than it was last year for transcendental ravings on a receding universe. We imperatively need to balance our own little account and take stock of where we are upon the earth as it is.

Not one of the President's lieutenants helped him to do this. In Section H (Anthropology), Sir Arthur Smith Woodward, the distinguished palaeontologist, gave a most interesting, scholarly survey of the present state of knowledge and opinion of early man. Apparently we date very far back and if skull capacity count were even bigger fools in the past than we are now. To-day, there are too many of us and we are a hopelessly quarrelsome lot: we seem to have learnt little wisdom from experience. What can geology, what can anthropology, tell us of the future? Whatever our age, how much older are we likely to be? *The Times* recently, in a thoughtful article, pronounced the opinion that probably there was enough petroleum to last out the century. Not oil alone but every other raw material of industry is being used without thought of the future. Modern mechanical progress is due to the introduction of a number of rare metals—chromium, nickel, tungsten, vanadium and others: at present rates of consumption the supply of these must soon be exhausted.

The Spectre of our Scientific Brocken is Phosphate—the nuclear element of the living cell, the assembling element from which apparently each cell makes its start. We are using this up at intolerable rates. Nothing is more certain than that we shall be suddenly pulled up some day, not far distant perhaps, by failure of supplies. We are fast washing ourselves into perdition, sending our substance to sea in no sieve but through huge canals. We may easily go out like the *Dinosaurs*. Geology holds the key to the supplies upon which we are drawing with no thought for the morrow. A Geological President might well have organised the resources of the Association to deal with the problem of the potential supply of all the natural materials now used by our complex civilisation. King Demos would have been warned and if not led to call a halt, at least to demand that all further use of nature's resources should be subject to scientific control. The present mad race merely to produce and sell cannot be allowed to continue: unrestricted exploitation of the world's treasures to commercial ends and profit must in some way soon be stayed. We are thought to be living in a period of superabundance because a few fools burn coffee or plough in cotton: in fact, we are wallowing in waste.

Rus et Urbe

Physics (A) and Chemistry (B) were as one this year, reminding us that the first is to the second what country is to town. The presidential addresses in the two subjects are already published in THE CHEMICAL AGE. Both are transcendent chemistry—clear but brief summaries of important chapters: the one, the story of the atomic unitaries, the so-called elements; the other, that of the complex carbohydrates. Far too condensed and technical in character as popular discourses, they would have been appropriately published as Chemical Society Reports.

Contrasting the two addresses, the difference between the methods used is very striking. The physicist, once armed with his instrument, is able to turn out results with a negligible margin of inaccuracy, without particular difficulty. The chemist is ever hampered by a complex procedure, first in securing completeness of interaction, then in isolating a satisfactory product, most difficult of all in determining its nature. The one is a mere philosophical observer, whilst the other is largely an artist contending with an unresponsive medium. Results have been quickly and neatly won in the field of "isotopes" but in that of the sugars very slowly and at great cost of labour and even of material. The chemist's life is not an easy one—credit is due to him, therefore, when he masters a field so difficult as that brought under notice at Norwich. In eventual, intrinsic, scientific importance, the conquest recorded in Section B over substances of such vital importance as starch and cellulose may well be said to outweigh that of all other events recorded at the

meeting. We are at last beginning to know how living structures are put together. I saw the work begun and have marked the slowness of progress: many have fallen by the way whom we should not forget in awarding the first prize. In fact, we have yet far to go but through fields that will ever grow in interest, before we can regard the chapter as final.

The late Sir Joseph Swan, the giant inventor, speaking of the impression produced upon him as a youth in the early days of photography by the introduction of the daguerreo type, remarks:

> "I feel strongly that acquaintance with these newly-discovered arts from the time of their birth greatly added to their impressiveness, giving them a vivid interest which those who have only been acquainted with them after they have attained a certain maturity and become common knowledge altogether missed. The elation created by the announcement of a great discovery and first acquaintance with its results is a sensation of an extraordinary uplifting character."

The two chapters in chemistry considered this year at the B.A. have been almost entirely written in my time. Young sailors in the now overcharted seas of our science can in no way picture how great has been the uplift ancient mariners like myself have had in watching the extraordinary development of modern knowledge—unfortunately the pleasure is balanced by pain, at seeing so little upgrowth of public ability to appreciate and apply methods which have ministered so greatly to the advance of civilisation.

Dr. Aston's story is like young wine—it lacks the developed palate sufficiency of a stored vintage. To write a full flavoured history of the gradual evolution of present-day knowledge of the "elements" is, to say the least, very difficult. The interpretation he gives of the view held by Crookes is scarcely correct. Crookes, I think, in no way anticipated Dr. Aston's great discovery—as he may seem to have done in the passage quoted by Dr. Aston from his 1886 B.A. sectional address. I knew him well from an early date and often talked with him on the subject, in connection with his work on the rare earths. He thought of atoms as being like peas—atomic weights as general means—just as the weight of a pea in a poke may be represented by a general mean pea value. He was a loose thinker, at best, although a marvellously acute and accurate observer.

The entry of Radium upon the scene; Rutherford and Soddy's great discovery of a radioactive, condensible emanation from Thoria; the recognition of Helium as a product of the spontaneous decomposition of the emanation; the interpretation which Soddy's genius led him to give of radioactive change and his introduction of the "isotope"—all these are explosive events which have altered the face of chemical science. Yet nothing new in principle has been established. We have merely extended to the elements a doctrine long familiar to workers in organic chemistry. Petroleum was at first just lamp oil—came Schorlemeiner and others, who showed that it contained specific hydrocarbons of the general composition $C_{n\ 2n+2}$: soon a whole homologous series of these, from CH_4 upwards, became known. When hydrocarbons generally were considered, it was found that they could be classified in upright, parallel series, beginning with the homologous paraffins, each advancing series differing from the one before by a constant decrement of 2H; such series are known as isologous series.

Homologous and Isologous Series

We now know that the elements may equally be arranged in homologous (vertical) and isologous (horizontal) series, like hydrocarbons. The special term isotope is not needed: Soddy's original description of isotopes as chemically identical and inseparable is an over-statement. Methane and ethane are only separable by physical means—yet we have no hesitation in regarding them as chemically different. The separation of common chlorine into two chlorines of weight 35 and 37, in proportions giving the fractional atomic weight ordinarily assigned to the element, came as no surprise to those of us who were alive to the order prevailing among hydrocarbons. I had the idea of a mixture at the back of my head from the time of reading Staas in the early '70's. One felt that no self-respecting element could have such a fractional atomic weight. In the same way, the proof that the elements are composite structures came as no surprise to those of us who were schooled in organic chemistry. No other interpretation was possible when once the significance of Mendeleeff's momentous generalisation was realised. The great discovery has been of methods which have made such elucidations of long-known facts possible.

In his determinations, Dr. Aston is concerned with quantities of 1 in 10,000, yet whilst ever striving for the highest possible approach to accuracy (of which there can be no degrees) in telling his story is careless in his choice of words, a proof that he is not yet fully schooled as a philosopher. Like so many, he persists in using the word theory as meaning hypothesis (doctrine, explanation, interpretation, speculation, guess). It is absurd to say:

> "Theory is the scaffolding of science and just as in ordinary building operations, though some part of it may only be used for a short time before removal, others may function for so long a period that they may well be mistaken for the permanent structure itself."

Theory is the picture of the finished structure. We have as yet very few theories, because so few of our pictures of structure are finished. Prior to Dr. Aston's finished work, we had but an atomic hypothesis: this he specially has raised to the dignity of a theory. The story is complete, indubitable, open to no contradictions. B.B.C. please note! Chemists may well cry "Hail, Aston!" never forgetting a certain wizard J.J. behind him, standing in the shadow of men such as Staas, Richards and Rayleigh. No work is to be read with greater profit by young chemists than that done by the men who have devoted their lives to the determination of atomic weights.

Shall We be Sugar Babies ?

This is one of the great problems that should have engaged the attention of Section B. All the chocolate maidens would have been attracted: a Prize of Norwich Rock might have been awarded to the best debater, in their judgment. The topic is also of supreme interest to Norfolk farmers. The number of furanose or pyranose units and the mode of their arrangement in the complex carbohydrates is a matter of supreme indifference to the world at large—the production and use of starch and cellulose may easily become of world-wide consequence. A full discussion of the use and abuse of carbohydrates in all its aspects would have been of important service to the community. The country wants to know whether or no the policy of growing sugar beet is one that can be justified on scientific grounds. Nowhere in Europe has sugar been produced from beet as an economic crop; everywhere the industry is bounty fed; under tropical conditions sugar is produced from sugar cane at half the cost of that from beet. It suits our farmers to grow beet, merely because it is a remunerative crop—because they obtain an artificial price for it, through State aid. Some products there must be against which we can exchange our goods: sugar would seem to be pre-eminently one of these; free trade in sugar on this ground would seem to be desirable.

Such being the case, the scientific reasons for and against the use of sugar should be fully considered. Sugar beet is a costly crop to grow, needing high manuring; during extraction of the sugar the salts stored in the roots are mostly washed away and lost. Sugar is not a natural food, except in the small quantities in which it is present in fruit and vegetables. In fact, it is a luxury food—we eat it because it is sweet and therefore palatable. Its value is solely that of a fuel food. It contains so little impurity that it may be termed pure—therefore it carries nothing with it, no mineral matter: all other foods contain more or less mineral matter and are of some constructive value as well as being fuels. The consumption of sugar has increased very much of late years, both here and in America. At the same time, there has been a great drop in the consumption of bread. It is said that habits are changing, especially in America: people are growing soft and even the type is changing: typically spare Yankee Doodles are no longer to be found. All fight seems to be going out of ourselves. By eating much sugar, children are necessarily deprived of many things that are desirable for their growth. As it spares fat, sugar is also a cause of obesity in grown-up people. It would seem to be desirable, on these grounds, to take stock of the situation and consider not only whether we should give up growing sugar beet but also greatly reduce the amount of sugar we eat—regarding it as a negative food by eating which we may deprive ourselves of necessary food. Even the poor yeast cell is deprived of nutriment, through displacement of malt by sugar—beer therefore suffers and can never be best until made from malt alone.

Manufacture of Quick-Hardening Cements

Use of the Iron-Smelting Blast Furnace

THE production of aluminous or quick-hardening cements in the ordinary iron smelting blast furnace is discussed by Dipl.-Eng. E. Reitler in " Technische Blätter," No. 25 (1935).

The quick-hardening property of calcium aluminate with water was investigated and established by Scholz in 1904, but it remained for the French chemist Bied to show how this knowledge could be applied industrially and the now well-known " Ciment Fondu " came on the market. The raw materials used in the making of this cement are limestone and bauxite from southern France. Concrete made with the cement is ready to take a full load 24 hours after it is laid. The successful development of the aluminous cements has stipulated makers of Portland cement to improve their products, and to-day many Portland cements, in respect of hardening energy, are scarcely inferior to aluminous cements, although the greater resistance to chemical attack of the latter gives them an advantage in many situations.

The methods used in the production of aluminous cements differ according to the furnace employed. One method employs a water-jacket shaft furnace of the type used in certain metallurgical operations. In this method the raw materials are mixed in the same way as for making Portland cement, except that they can be less finely milled. This mixture is charged alternately with coke into the mouth of the shaft furnace and, by the aid of air blast, is brought to the melting point, which is about 1,500° to 1,600° C. The daily output of the usual sized furnace is about 50 tons of cement; the coke consumption is about 50 per cent. of the cement output. Iron oxide in the bauxite become mainly reduced to metallic iron which gravitates to the bottom of the furnace and is tapped off, while the molten cement materials resemble the slag in the ordinary iron smelting blast furnace. The slag is cast into moulds and after cooling is broken up and finely pulverised in the same way as Portland cement clinker. The degree of fineness obtained in milling is such that only 3 to 5 per cent. remains on a sieve with 4,900 holes to the square centimetre.

Use of Electrical Pan Furnaces

Aluminous cements are made also in electrical pan furnaces. Here the raw materials need not be very finely broken, but the limestone must be burnt before charging to drive out the carbon dioxide gas which would otherwise escape with too much violence in the melting zone of the furnace. In the furnace usually employed, the calcining of the limestone occurs in the shaft-like upper part of the furnace, and the de-gassed product sinks by gravity into the melting pan. In the furnace, strong carbon electrodes form one pole, and the melting pan the other pole. The heat is generated by the resistance of the charge to the passage of the electric current so that the furnace acts as a resistance furnace; the heat melts and maintains liquid cement material. Arcing must be avoided as this would result in calcium carbide being produced, a quite small percentage of which can make the cement unusable. In some cases both the limestone and the bauxite are calcined before being charged to the electric furnace; this favours the reduction of any iron oxide in the charge. Contrary to some published statements there is no production of ferrosilicon; this would require a much greater temperature than is used in the cement furnace, which seldom exceeds 1,600° C.

Generally, the manufacture of aluminous cements in the electric furnace is too dear on account of the large current consumption per kg. of cement, and there is also a heavy consumption of the carbon electrodes. The furnace units are not very large and a daily output of cement may not exceed 10 tons, although there are some larger furnace units.

With a view to cheapening the production of aluminous cements, the idea of obtaining these as slags in the ordinary blast furnace smelting of iron ores has been experimentally tested. As long ago as 1904, the Pennsylvania Steel Co. experimented in their Steelton works with a highly aluminous fluxing material, not with a view to obtaining a slag with cement properties, but to obtain a good pig iron from refractory Mayari iron ore. The coke consumption was very high and the attempt was regarded as a failure. With the same object, experiments were made in 1924 with better results; a slag containing 30 per cent. alumina, and 20 to 25 per cent. silica was obtained, and the pig iron product was of normal quality. In 1927 further experiments along the same line resulted in the obtaining of a slag with 49 per cent. alumina, 42 per cent. lime, 4 to 5 per cent. silica and 1 per cent. ferrous oxide. This experimental work was carried out in a blast furnace of about 16 cubic metres useful capacity and, therefore, small; the charge consisted of bauxite and limestone, iron ore low in silica, or iron scrap, or both ore and scrap. The desired composition for the slag was reached approximately, although the silica content was somewhat too high. The pig iron production, however, was small and unimportant.

Experiments in Germany

Similar experiments, but in a normal sized blast furnace, were made by the Rolandshütte, of Wiedenau, Germany, in their Lübeck blast furnace works, 1925-1928. In these experiments, the object in view was to produce a good aluminous cement and simultaneously a good pig iron yield in something like ordinary blast furnace practice. According to a report published in " Archiv. für das Eisenhüttenwesen," 5th Year, Istrian bauxite was used in the first period, French bauxite in the second period, and Istrian bauxite in the third period. The ferruginous material used in the first period was sinter from the rolling mills and some burnt pyrites. Later, however, Russian iron ore from the Krivoi-Rog iron-ore field and scrap iron were used. The operations proceeded quite smoothly, but the consumption of coke was somewhat high. The composition of the slag was satisfactory, and was obtained without difficulty with about 45 per cent. alumina, 42 per cent. lime, less than 10 per cent. silica, and about 2 per cent. ferrous oxide, and in its cement properties corresponded to expectations. The pig iron product was high in carbon (4 to 5 per cent.) but was low in silicon and sulphur. It resembled the high-carbon Swedish charcoal pig iron, usually showing a variegated coloured fracture, being rarely pure gray or pure white. This result showed that there was no difficulty in ordinary blast furnace practice in obtaining a good pig iron with an aluminous flux, and a slag possessing the properties of a quick-hardening cement.

Economic Aspect of the Process

The economic aspect of the process was tested in a separate series of experiments extending over 2½ months. Hessian and Istrian bauxites and mixtures of the two, were used with limestone, scrap iron and coke. The iron was tapped off from the furnace in the usual way, while the slag was discharged into pan wagons in which it was cooled and passed on to the cement section. The desired quality of pig iron was obtained in this way without difficulty; for the most part it was grey, or grey with some white spots, and rarely white with grey spots. The composition of the slag averaged over 45 per cent. alumina, while the lime did not exceed 40 per cent. and the silica 7.5 per cent; the ferrous oxide was from 2 to 4 per cent.

The cement properties of the resulting slag were extensively investigated, and when wetted with water it reached a tensile strength of 35.3 kg. and a compression strength of 698 kg. per sq. cm. in 24 hours. After 28 days, the tensile and compression strengths reached values of 49.2 and 951 kg. respectively per sq. cm., and thus much higher values than are specified for Portand cements.

In general, the economy of a blast furnace is measured by the consumption of coke per ton of pig iron produced; the slag is a more or less undesired by-product, the quantity of which is kept as low as possible. However, in the above described combination of pig iron and high grade cement production, coke consumption cannot be regarded as the basis for calculating the economy. There can be no doubt that the simultaneous production of pig iron and aluminous cement in the blast furnace must be highly profitable where the cost of the bauxite is not loaded too greatly with freightage charges.

Steam Traps and Strainers

By PROFESSOR F. C. LEA, D.Sc., M.Inst.C.E., M.I.Mech.E.

THE desirability of clean dry steam being delivered for most industrial purposes, whether as the motive power for steam engines, for heating or drying or other industrial process, is recognised by most users of steam. However well a steam pipe is insulated some radiation of heat is bound to take place and, unless the steam is considerably superheated, condensation of steam and accumulation of water follows. In a well insulated steam line the quantity of condensate that has to be dealt with as compared with the volume of steam piping along the pipe line will generally be small. When steam is passed through heaters or dryers the quantity of steam in the heating unit is comparatively small as compared with the condensate, and thus rapid evacuation of air and water is desirable.

The Purpose of a Steam Trap

The purpose of a steam trap is to allow water to escape readily whilst preventing the escape of steam. For the trap to be continuously effective it should operate when water accumulates but should not allow steam to pass. A leaky trap will clearly remove water from the steam line but it will be costly in wasting heat. A simple calculation will make this clear. The total heat of steam at a pressure of 100 lb. per sq. in. reckoned from 32° F. is 1194 B.Th.U. per lb., the temperature of the steam is 337.5° F., so that for every lb. of steam that escapes, more than three times the quantity of heat is thrown away than is lost for every lb. of water that leaves the trap. It is essential, therefore, that the valves of the trap should be kept in a steam-tight condition, otherwise in some modern plants, particularly steam heating plants, where a very considerable number of traps are installed, the cost due to the leaking of steam may be considerable.

Water that accumulates in a steam pipe line may be a source of considerable danger, particularly if the line is allowed to cool down and hot steam is then admitted to the pipe. The hot steam coming into contact with cool water may be suddenly condensed, a partial vacuum formed, and a mass of water set violently in motion. At some point in the pipe line this will be brought suddenly to rest and fracture is likely to occur. The reports of the boiler insurance companies give instances of such movements which have not only led to considerable damage, but also not infrequently to loss of life. Condensed steam accumulating in a heating coil diminishes the volume of steam passing through the heater and hence the efficiency. The admission of wet steam to reciprocating engines is not only uneconomical, but is also a source of danger, especially during compression when the exhaust valve is closed. The work done per lb. of steam also passing through the engine is less than if the steam is dry, or in other words, wet steam means efficiency and the risk of damage in the pipe line and in the engine. By removing condensed water from the steam line or from heaters, not only is risk removed and efficiency increased, but, if thought desirable, the water can be returned to the hot well from which the boiler is fed, and thus the sensible heat of the steam is recovered instead of being thrown to waste as water in the engine exhaust.

Essential Features of a Good Trap

It is not an exaggeration to say that millions of traps have been fitted to steam pipe lines and process plants, and they must therefore be considered as an important auxiliary to steam transmission. The essential feature required of a trap that it should allow water to escape while preventing steam from doing so, requires that it shall be robust and reliable, that no sticking of moving parts shall be possible, that corrosion, erosion and wear should as far as possible be prevented and that dirt should not lodge on valves or any other moving parts that would prevent the effective sealing of the valve against the flow of steam. The design and the physical properties of the materials of which traps are made should, therefore, be satisfactory not only at ordinary temperatures, but also at the temperature at which the traps work; that is, they should have sufficient strength, hardness and resistance to fatigue to avoid any possibility of failure by fracture or deformation during the working life of the trap. They should also resist corrosion and erosion. Rapidly moving water, and particularly a mixture of rapidly moving water and steam, causes erosion of surfaces. Pitting of valves or valve seats may take place if steam is allowed to escape alone, or along with the water, because of imperfect fit due to dirt collecting on the valve seatings or corrosion or erosion of the faces having taken place.

Traps are generally designed so that they can deal with a certain quantity of dirt which can be blown out of the recepticle by opening a suitably arranged valve. This may require a packing gland made of suitable materials. Some engineers require a strainer to be fitted up-stream to prevent the entry of solid matter into the trap. To avoid the risk of steam escaping through partially or imperfectly closed valves some traps are made without them, as for example, one type of trap has a Monel metal cone-shaped plug with a series of grooves forming a labyrinth seal. The collected water with a steam pressure behind it accumulates at the smaller and lower end of the plug and is blown through the labyrinth to the outlet of the trap. Steam cannot pass through the labyrinth with the ease of water so that if the size of the trap is correctly chosen to deal with the quantity of condensed steam, the action is continuous and only water escapes. Many types of traps, however, are fitted with valves and controlled by bucket floats or other arrangements, which are opened periodically for the water to escape and are then closed until sufficient water has accumulated for the valve again to open.

When sufficient water has accumulated the valve should automatically open and the steam pressure eject the water. Before steam can escape the valve should close quickly and securely so that no dribbling of water or leakage of steam is possible. In one type of trap with a bucket float the valve each time it closes is given a rotational movement brought about by the escaping fluid passing between spirally arranged vanes. This trap has a blow-off arrangement, the stuffing box for which is made of Monel metal. In a third type of trap the control valve is a sphere of Monel metal which rotates each time that it comes into action and does not seat twice in the same place. The ball floats in the condensate with its horizontal diameter submerged and stops flow before steam can possibly escape. Any accumulating dirt is easily blown through the valve opening.

Steam Strainers

It has already been remarked that dirt may be carried along pipe lines and that steam strainers are not infrequently fitted up-stream from steam traps. The high velocities at which high pressure superheated steam passes through the nozzles or vanes of modern turbines and strikes the moving vanes, make it eminently desirable that all water and solid particles shall be removed from the steam. The treatment of waters to prevent scaling and corrosion in boilers may lead to the carrying over from the boiler of salts in solution or of solid particles which may be deposited in the superheater, thus leading to the choking of the superheater, the diminution of its efficiency and the risk of local overheating leading to failure of tubes. The comparatively large volume of steam liberated per unit area of free water surface in modern boilers means that steam is violently liberated and unless the steam, before entering the steam pipe or superheater, is passed through an effective strainer, solid particles and water may be carried over.

Steam strainers of the wire cloth type may be fitted in pipe lines carrying either saturated or superheated steam, the mesh being sufficiently fine to remove solid particles coming over from the boiler or picked up from the pipe line before the steam enters traps, engines, turbines or process plants. The advantages of a certain type of wire cloth strainer form the subject of a patent in which it is claimed that wire cloth is superior to perforated sheet, since with high velocity steam the round wire forming the sides of the hole has a streamline effect on the steam and therefore for the same filtering efficiency has a smaller throttling effect than round or square holes drilled or punched through a plate.

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Automatic Temperature Control

Its Application in the Chemical Industry

Some General and Fundamental Considerations which should be taken into account in Designing or Installing any System of Automatic Temperature Control

IN the compass of this article it is not possible even to mention all the varieties of electrical pyrometers which are arranged to control temperature automatically in chemical processes, nor to enumerate the very many cases where such systems of control have been successfully applied. There are, however, certain fundamental factors which should be taken into consideration before such an automatic control pyrometer is selected. Very often these considerations are neglected, sometimes due to ignorant enthusiasm on the part of the maker of the instrumental apparatus, and sometimes aided and abetted by a similar enthusiasm on the part of the works manager.

It should not be assumed that automatic temperature control, by means of an electrical pyrometer, is unsuccessful; in fact, when the factors mentioned are properly taken into account, the advantages in accuracy of heating and in rapidity of output are surprising even to the most enthusiastic advocate of such systems.

The Chain of Operations

In order to visualise the chain of operations which takes place in such control systems, the diagram in Fig. 1 will be useful. Here we have a very simple system comprising a furnace (F) whose heated zone (Z) is to be controlled at or close to the selected temperature. This furnace is heated by a natural draft gas burner (B) having a supply pipe (G), thus the supply of heat will be controlled by the amount of gas passing. This is determined by the position of an electrically-operated throttle valve (V). Inserted in the zone (Z) is a thermo-couple (T) protected, if the temperature

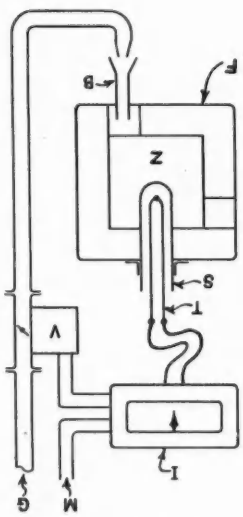


Fig. 1.—Diagram of Automatic Control System.

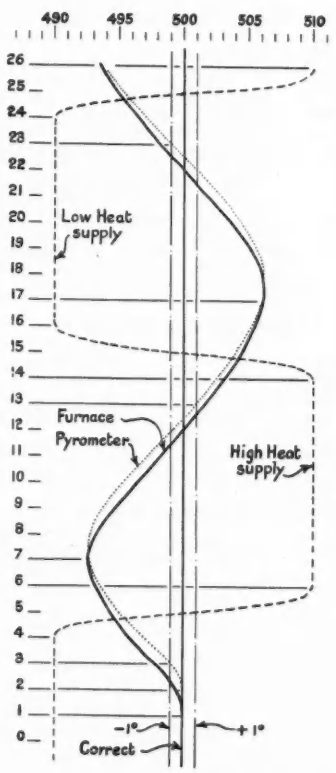


Fig. 2.—Time-Temperature Chart.

is high, by an exterior sheath (S). The thermo-couple is connected to a pyrometer indicator of the usual "edgewise" type (I). This part of the apparatus is identical with an ordinary simple indicating pyrometer, but incorporated in the indicator is some form of mechanism, for instance, driven by an electrical supply (M) from the lighting mains arranged so that if the temperature rises definitely above the control temperature a relay circuit will be closed to the valve (V) to reduce the supply of gas. If the temperature falls below the desired figure the converse takes place. In all such systems, although closeness of control is a desirable factor, it is usually mechanically necessary to have some minute amount of "dead space" just above and just below the control temperature within which the pointer may move up or down the scale without altering the condition of the control.

To follow out the operation of a control system as in Fig. 1, let it be assumed that there is a small change in the temperature of the zone (Z). This change has first to penetrate through the sheath and then to reach the heat-sensitive junction of the thermo-couple. If the position chosen for the thermo-couple and its sheath is a suitable one and the type of thermo-couple and sheath is such as to respond quickly to temperature change, these steps need only occupy a few seconds. Next, the change in E.M.F. from the thermo-couple has to cause a change in the position of the pointer on the scale of the indicator, this, in a good pyrometer will be so rapid as to be negligible compared with other time intervals. The mechanism for securing the closing of the relay circuit to the valve is usually periodic in its operation, say, once in 10 seconds, so that there may be here a maximum time interval of that amount before the valve is actually moved to change the supply of gas. If the valve (V) is near to the burner (B), the change in the flow of gas at the burner will also take place promptly.

The Last Link in the Chain

It will be seen that there is reasonable expectation that all of these successive operations can take place rapidly and they are all concerned with the apparatus supplied by the instrument maker and the valve maker. But now we come to the last link in the chain, which is not within the control of these people but depends upon the nature and the size of the furnace. The change in the supply of gas has to produce a change in the temperature of the furnace so as to restore it to the original correct figure and here there may be a very considerable lag. It should be noted that, during this time lag in the furnace itself, the control apparatus will be operating to supply the changed amount of heat. If the instrumental part of the equipment is of good design and suitable for the work, yet there appears to be hunting in actual operation, the first thing to look at is a serious time lag in the furnace itself. Not until the temperature has been restored to its original figure and this restoration has penetrated to the thermo-couple will the posture of the apparatus return to its original condition.

It is helpful to consider this sequence by aid of a time-temperature diagram, as shown in Fig. 2. This diagram is arranged as is usual on continuous-chart pyrometer recorders with the earlier times at the bottom, later times at the top, low temperature to the left and high temperature to the right. It has been divided arbitrarily into equal time intervals which might each be, for instance, 10 seconds. There is a black solid line showing the temperature of the furnace and a dotted line showing the temperature experienced by the pyrometer. There is also the line of dashes indicating the posture of the supply of heat which, in this case, is of the "hit or miss" type oscillating sharply between a low supply and a high supply.

Steady Temperatures

On work of a continuous and regular nature, where the primary heat supply is itself not subject to large variations—in the example in Fig. 1 the pressure and calorific value of the gas would be nearly constant—it is easy to arrange for a by-pass supply which is always on and which, by itself, would result in a steady temperature definitely below the desired control temperature. There is then an additional supply governed by the control pyrometer, which, if also always on, would result in a steady temperature definitely

above the control figure, thus the extreme oscillations could only be between these two figures. In this example the "dead space" is shown as plus or minus 1°, the control being set for 500°. The sequence may now be studied, at time 0 the temperature was correct, but at time 1 for some reason the temperature of the furnace began to fall. At time 2 the pyrometer began to experience this fall, but it had not passed beyond the dead space until time 3. At time 4 this fall has had effect upon the valve which begins to admit more gas, the increase being complete by time 6, but in the meantime the temperature has still been continuing its fall so that it is not until time 7 that the temperature line turns round and begins to climb again, the change being experienced by the pyrometer at time 8. The high heat supply will remain on until the pyrometer has passed above the dead space at time 13. As a result, at time 14 the valve begins to close, leaving only the by-pass on by time 16 and then the process is repeated in the reverse direction.

A Trap for the Unwary

It will be seen that, in this case, the major part of the time lag responsible for the oscillation or hunting of the temperature is that in the furnace, yet, in the supposed example, that furnace has been fairly prompt in response and this diagram illustrates one of the traps into which the unwary instrument maker may fall. Knowing that his pyrometer will operate in the required sense when the temperature has departed only 1° from the desired figure, he boldly claims

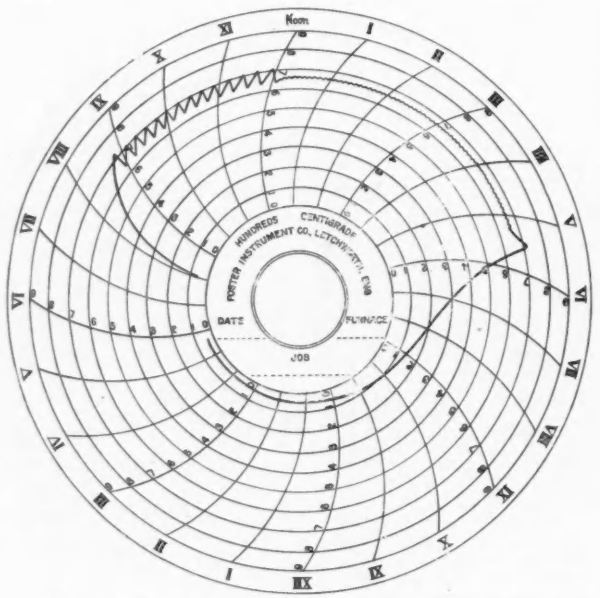


Fig. 3.—Recorder Chart contrasting Slow and Quick Thermo-couples.

that his apparatus will control to plus or minus 1°; as is evident in practice it will do nothing of the kind.

In those cases where the furnace has a large inherent "flywheel" effect, the tendency to hunt may not be so large and in such cases (usually associated with large furnaces) it may be preferable to make the control operate in a series of small steps instead of on the "hit or miss" principle, but the same general factors of time lag have to be taken into account. In addition to the steadying effect of the furnace itself there is also the mass and thermal capacity of the material under treatment. If this is large compared with the thermo-couple and its sheath, this material will not experience to the full the temperature oscillations as shown in the diagram. Fig. 3 illustrates this point.

Quick and Slow Thermo-couples

A small electric furnace governed by an electrical pyrometer on the hit or miss principle had inserted in it two thermo-couples, one without any sheath and of thin wires, and therefore very quick in response, the other enclosed in a relatively heavy sheath and therefore slow to respond. In the first part of the curve the furnace was controlled by the slow thermo-couple, while the quick thermo-couple was connected to the recorder whose chart is shown, to act as a tell-tale, and it will be seen that, because the thermo-couple was slow to experience the changes in furnace temperature when operated by the control, the temperature oscillation was quite large. Subsequently, without changing anything else, the quick thermo-couple was connected to the control and the slow thermo-couple to the tell-tale recorder. It will be seen then that the oscillations of temperature are so small and rapid as hardly to be distinguished from a steady line. This shows how the slow thermo-couple hardly experienced any temperature oscillation, because the quick thermo-couple experienced the temperature change almost immediately and made the corresponding correction to the heating before the slow thermo-couple had time to perceive the change. The slow thermo-couple might fairly represent the material under treatment in the furnace and therefore it is clear that that material would experience virtually a steady temperature. Of course, in this case, the electric furnace being small, furnace lag as such came in only to a very minute extent.

Need for Prompt Change

From the foregoing considerations certain general conclusions stand out. Firstly, as a purely indicating or recording electrical pyrometer, we must choose the apparatus that is not only capable of adapting to automatic control but so that it will quickly experience changes in the "key" temperature in the zone to be controlled; in the case of relatively low temperatures the resistance thermometer "bulb," or the thermo-couple, may possibly be employed without an exterior sheath, it will therefore be quick to respond to temperature change. We must then arrange the switch, valve or other secondary element of the control so that it will move promptly and accurately to make the desired change in the supply of heat. This is not to say that it need make a large change for, in the case of the "step by step" system previously mentioned, there may be a large number of small successive changes in the supply of heat. But whatever changes are appropriate they should occur promptly after the necessity has been recorded by the pyrometer.

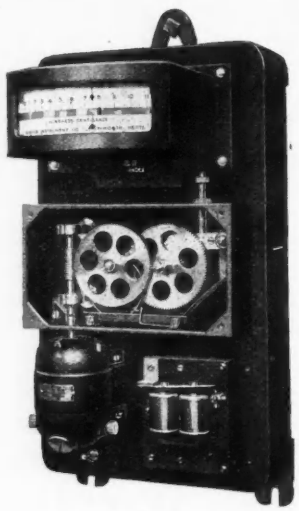


Fig. 4.—Typical Automatic Control Panel.

Thirdly, the supply pipes of gas, oil, air and so forth should be arranged so that there is not a large reserve or reservoir between the control valve and the burner or other heat-liberating device otherwise the capacity of this intervening piping will cause an objectionable lag. The lesson here is, of course, that the valve should be as close as possible to the burner. Of course, in the case of an electrically-heated apparatus the current will flow virtually instantaneously after the closing of the switch. Fourthly, the available supply of heat should be as nearly constant as possible, in the case of gas a pressure governor may be desirable, alternatively, with oil, the fluidity and the pressure of the oil should be constant once the furnace is running. Lastly, the details of the furnace itself should be such that

it promptly responds to a change in the supply of heat. In this connection those furnaces which have a forced internal circulation have surprisingly great advantages when operated with automatic control.

Automatic control pyrometers are of various types; that shown in Fig. 4, though obsolete now in detail, is useful to illustrate a system widely employed. The thermo-couple, with its sheath and connections, is identical with what would be chosen for an ordinary indicating pyrometer and the edge-wise indicator is also similar. But inside the indicator case, above the pointer, is a presser bar which is periodically allowed to descend by means of the plunger shown projecting upwards into the indicator base from the gear box below it. The self-oiling reduction gear in that bax is driven by the small electric motor, also shown. When the temperature rises materially above the desired figure, the next depression of the pointer closes the primary contacts to the relay shown at the bottom of the panel, the secondary of which in turn operates an electrical valve to cut off the heat supply.

One of the most valuable qualities of electrical control pyrometers is the great flexibility in design and application. By choosing an electrical resistance thermometer, a thermo-couple or a radiation pyrometer, temperatures of almost any range may be governed automatically, the type of indicator or recorder being broadly the same in each case. Similarly, having closed a relay circuit that may operate directly to put on the heating to a small electric furnace, or in cascade fashion, to close the contactor of a large electric furnace. Alternatively, it may operate a motor to open or close a valve, damper or other device.

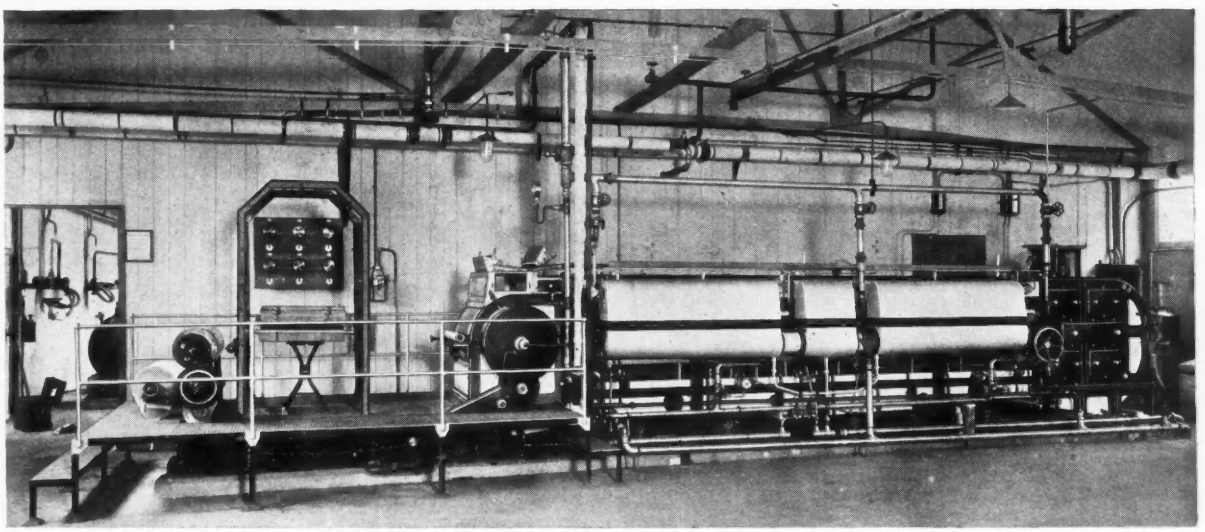
Speciality Machinery

Engineering for the Requirements of the Plant User

ONLY a very few organisations are big enough to control their own engineering works, thus being in the position of developing their particular machinery with absolute secrecy; the majority have to apply to outside engineers for the supply of the necessary machinery, and works managers and engineers have been known to experience great difficulty in obtaining just the type of machine they require to fulfil their particular purpose.

In some cases machines of a certain type already in existence can be utilised or easily adapted for a particular process, whilst in other cases it is necessary to evolve an entirely new machine with nothing more than an idea or very crude model as a starting point. It is inevitable that in some instances certain facts and necessary information must be disclosed to the engineers concerned to enable them to fully appreciate the nature of the product, and it is only natural that manufacturers are extremely loath to transmit such information which they usually consider to be more or less secret and therefore possibly of much value to themselves

It is generally recognised that roughly 90 per cent. of speciality machinery is imported into this country and it rather appears that English manufacturers have preferred to do business abroad in this respect rather than approach home engineers with their machinery problems. Perhaps some of the blame can be placed to our engineers in not making it known sufficiently that they are prepared to cater for this class of business, whilst the foreign firms regularly advertise their machinery in the British trade journals. It is therefore quite likely that our own manufacturers have asked Continental or American firms to supply a machine for a certain purpose, giving only very vague particulars of the product. The result usual in these cases is that when the machine is delivered and tried out it does not actually meet the requirements and much inconvenience and delay is caused in putting matters right. Naturally the engineers are called in to do the necessary adjustments and very often the cause of failure is simply and quite rightly put down to lack of information in the first place. What is the result? This information now has to be divulged, much experimental work carried out on manufacturer's own premises and valuable data handed over to foreign engineers which is embodied in future machinery and eventually sold to competitors.



The latest type of Band Casting Machine used in the manufacture of transparent wrapping papers, etc.

This is probably the principal reason why foreign engineers have obtained such a strong hold on the English market and also the world's market as they have gained greatly in experience through repeated demands for their products.

There are English engineers, however, who are prepared to cope with the special machinery problems of manufacturers. W. H. Pease and Co., Ltd., although a recently-formed organisation, have an executive and staff widely experienced in various special process machinery embracing many trades. Not only have the staff the necessary qualifications in the design of machinery but have actually had years of practical experience in a variety of industrial undertakings, and particularly those concerned with the production of transpatent foils, wrappings, coated papers, photographic papers and films, artificial silk, etc. This organisation is prepared to supply complete factory equipment for such industries.

Fire Protection for Chemical Works

Latest Scientific Principles of the Application of Foam

THERE are now two general methods in standard use for fighting fires—water and carbon dioxide (in its various forms). Water is, of course, extremely valuable both as hydrants and permanently installed sprinklers, but for chemical works, oil refineries, oil and petrol storage tanks, and similar establishments, it has a number of disadvantages. Apart from the damage by flooding, it cannot be used in the presence of high tension electrical equipment and also will not extinguish fires caused by burning petrol, oil, benzole, toluol, alcohol, ether, tar, pitch, bitumen and similar inflammable products, which merely float on the surface and continue to burn.

Of great interest for chemical works and oil refineries are the latest designs of fire-fighting equipment supplied by Foamite Firefoam, Ltd., especially equipment of the " foam " and carbon dioxide gas types.

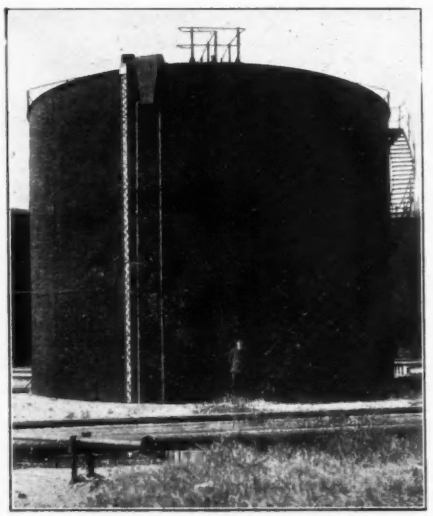
A typical example of foam protection for oil plant is installed at the new refinery, having a capacity of 30,000 tons (approximately 220,000 barrels) of crude oil per annum, recently completed for Cork Harbour Oil Wharves, Ltd., on Haulbowline Island, opposite Queenstown Harbour, Irish Free State. This installation includes a crude oil still having

Duomixer for use in connection with oil storage tanks and chemical plant where conditions do not favour the installation of a two-solution plant with central force pumps

a duty of 600 barrels per 24 hours and complete accessory plant producing 3,000,000 gals. of high-grade petrol per annum, along with kerosene, gas oil, lubricating oil and all the usual fractions, mostly the crude oil being delivered from Peru and other parts of South America. There are seven large oil storage tanks, three of 92 feet diameter, two of 45 feet diameter, and two of 35 feet diameter, all of which are provided with permanent foam mixing and discharge chambers.

It will be remembered that the foam method consists in the use of two powders, acid and alkali, which on mixing with water generate a vast volume of bubbles. These powders are a bicarbonate (with the addition of a foam " stabiliser," which is an organic colloid) and a harmless acid salt. The latter interacts with the alkaline bicarbonate to give carbon dioxide, in addition to a hydrate. As a result, small bubbles are formed composed of a film of the hydrate filled with carbon dioxide gas, the walls being strengthened by the colloidal stabiliser so that no collapse takes place on contact with a fire. Essentially the action of a mass of closely associated, wet, tough, small carbon dioxide bubbles of this type is both elimination of air by a non-inflammable gas and " smothering " of the flames, since combustion cannot take place in an atmosphere of less than about 17 per cent. oxygen, along with cooling to below the ignition point.

Foam can be used in many different ways, and the principle adopted for the Cork Wharves refinery is a permanent installation of pipes on each tank, with portable " Duomixers " and the two powders in tins kept at a central spot. That is, all the tanks have two vertical pipes on the outside leading from the ground to a mixing and deflector hooded chamber at the top, so arranged in the side of the tank that



Standard system of foam protection against fire for oil storage tanks, with two vertical supply pipes and mixing chamber at the top of the tank.

even if the roof is blown off the action proceeds as usual. When a fire starts in one of the tanks the portable " Duomixer " is immediately connected to the vertical tank pipes. These mixers consist essentially of two hoppers leading to two small horizontal injector compartments at the bottom,

Left.—Standard " Foamite " 2-gal. extinguisher, tested to 530 lb. pressure.

Above.—Standard " Foamite " dual seal hand extinguisher, 1 gal. size.

one end of which in each case is coupled by instantaneous fire hose couplings to the corresponding tank pipe, and the other to an adjoining pressure water supply main, which may be fresh or salt water. The two powders pass down continuously from the hoppers and dissolve in the water so that the separate solution passes up each of the pipes and enters the mixing chamber at the top. Here the solutions come into contact and generate foam bubbles, which are deflected by the hood outlet over the whole surface of the burning oil and thus rapidly extinguish the flames.

Various other methods are available for oil tanks and chemical plant generally. For example, the two solutions can be kept in tanks in a large central depôt and pumped by means of a force pump through permanently-installed pipelines with control valves connecting to each tank and other danger spot. In the case of oil-operated ships, the two tanks are fixed on the boat deck high up above the engine room or firing floor, resulting in efficient operation merely by gravity.

Apart from the "Duomixer," the ordinary standard "Foamite Generator" is available, either fixed in a permanent pipe range when relatively short distances are involved, or carried from place to place as required. The above generator has a single hopper into which is poured the mixed dry powders, leading to a short horizontal injector apparatus at the bottom, having at each end instantaneous fire hose connections. For use, hose is coupled to the pressure water mains and water (fresh or salt) passed through, when the mixed powder is drawn into the water stream, and foam discharges at the nozzle. This "Foamite Generator" is made in three standard sizes: the "No. 15," under-water pressure conditions of 100 lb. per square inch, takes 50 gal. of water and 90 lb. of the dry powder per minute, giving 450 gal. of foam product. The larger models under the same general conditions take respectively 100 gal. of water and 200 lb. of powder, and 250 gal. of water and 400 lb. of powder per minute. Flexible hose is often used for the foam on the same lines as for water: the "No. 15" generator, at 100 lb. water pressure, with 150 feet of 2½-in. hose and a 1¾-in. nozzle, gives a foam jet 80 feet in length.

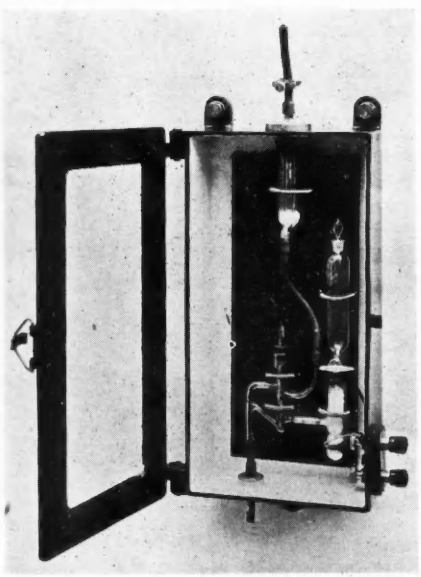
The "Foamite" hand foam extinguishers consist of cylinders brought into action merely by turning upside down, whereby a powerful jet of foam is at once made available. The acid solution is contained in a small open mouthed vessel fixed inside the cylinder, while the main body is filled with the solution of the alkaline salt. On turning the cylinder upside down the acid salt is discharged into the alkaline solution and generates the bubbles filled with carbon dioxide gas. The standard 1-gal. "plain cap" hand foam extinguisher is in the form of a cylinder 16 inch high by 6¼ inch diameter, and weighs 22½ lb. when charged; it holds about 1 gal. of liquid and giving 8 gal. of foam as a pressure jet 25 feet in length. For special cases, where there are condition of a hot atmosphere or bad vibration, there is supplied the patent "dual seal" type of 1-gal. extinguisher. In place of the plain cap at the top there is a lever device which closes a valve and seals the inner chamber and nozzle outlet so that no loss of liquid can take place, whether by evaporation or otherwise. In using the apparatus, all that it necessary is to pull the lever up to release the valve and then turn the cylinder upside down as before.

New Instruments for Industrial Use

Increased Efficiency and Accuracy

THE marked progress that industry has shown in the past few years has been synonymous with the increase in efficiency of the measuring instruments now widely employed in industrial processes. New instruments have been developed and old ones have been improved or modified to meet present-day needs. The main tendencies in this development have been to simplify operation, increase robustness and accuracy and to ensure reliability under working conditions.

Industrial processes must be capable of producing uniform products under the most economical conditions, both as regards time and labour. Sometimes this can best be effected by manual operation guided by the use of accurate measuring instruments. In such cases it is necessary that instruments should be conveniently mounted, have bold scales and open ranges. Alternatively, it can often be arranged that an entire process may be automatically controlled, in which case the utmost reliability is essential and it is desirable that a continuous record of the process be available.



Quinhydrone Continuous Flow Electrodes for pH Controllers and Recorders.

Of particular interest to the chemical industry is the marked advance that has taken place in the development of instruments for measuring or continuously recording hydrogen ion concentration. Previously this work has been largely carried out in the laboratory, but the methods have now been so simplified and perfected that measurements can now be made as a routine practice by unqualified observers. The Cambridge electrometer valve *p*H and *r*H meter is the best known and most convenient form of instrument and enables quick and accurate routine determinations to be made. It is suitable for use with any type of electrode, but the most usual type is the Morton glass electrode. A sensitive pointer galvanometer is employed to standardise the instrument against a Weston normal cell, and a compensating resistance is provided which, when set to the temperature of the liquid being tested, automatically introduces a temperature correction, so that the test value may be read direct from the scale. When the instrument has been standardised for valve characteristics and against a standard buffer solution, a reference

Surface Tension Measuring Apparatus.

adjustment is made, which can be referred to from time to time to check the standardisation. The range of the instrument is 14 *p*H units or 28 *r*H units. In addition to measuring instruments of this type continuous flow electrode systems have been designed to work in conjunction with recorders and controllers for applications such as the control of *p*H and *r*H in brewing, leather, milk, food, and many other industries.

The measurement of the surface tension of liquids is useful in various industrial investigations. The apparatus designed by Dr. P. L. du Noüy and manufactured by the Cambridge Instrument Co., employs the ring method of determination. A platinum iridium wire loop with a periphery of 4 cm. is hooked by means of a stirrup (D) to a hollow light steel lever (C), which is clamped to a fine steel wire stretched between end supports. The vessel (E) containing the liquid to be tested is raised by means of screw adjustments (F and G) until the platinum loop just makes contact with the liquid.

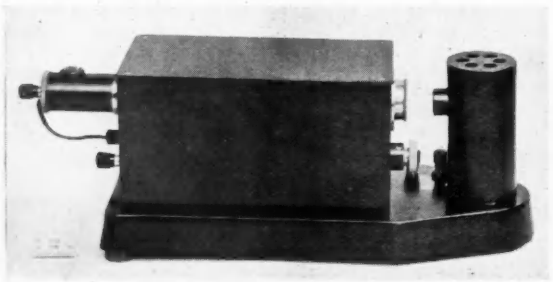


Photo-Electric Densitometer.

Torsion is then gradually applied to the stretched wire, a pointer (B) indicating the force, until the loop of wire breaks away from the liquid. The reading indicated by the pointer can then be compared with a standardising reading, obtained by testing pure water at 18° C. As only about 1 cc. of liquid is required for a determination to be made the instrument is particularly useful for tests on fluids which are only available in small quantities.

Moisture Content of Powders

The moisture content of any powdered or granular substances which are electrical insulators in a dry state, can be quickly determined by the Cambridge humidity tester. The substance to be tested becomes the dielectric in an electrical condenser made in the form of a container. The capacitance is measured by means of a condenser bridge network, and as the capacity measured depends on the moisture present in the substance being tested the reading is expressed in terms of percentage moisture.

Colorimetric Comparisons

Colorimetric comparisons in the past have to a large extent been made by eye and differences in results were inevitable since a comparison made by one observer, would not necessarily agree with that made by another. With the photo-electric densitometer the human factor is eliminated, comparisons are easily and quickly made, and results can be repeated consistently. Two rectifier type photo-electric cells are employed in the apparatus The first of these has a rectangular aperture on to which a circle of uniform illumination, slightly larger in diameter than the diagonal of the rectangle, is projected so that a definite proportion of the incident light produces current in the cell circuit. This current operates a galvanometer movement carrying an exponentially shaped aperture; increasing light causes the aperture to be moved so as to reduce the amount of light reaching the second photo-cell, and vice versa, so that the beam of light by which the colorimetric determination is made is of constant intensity, and not affected by variations in the electricity supply. The second photo-cell receives the light projected through the liquid, and the photo-electric current measured on a micro-ammeter indicates the optical density of the liquid. The insertion of coloured filters makes it necessary to alter the sensitivity of both the galvanometer controlling the light intensity and of the milliammeter. As a disc is rotated to bring in the different coloured filters, cams on the spindle operate leaf switches which put resistances of appropriate values into the galvanometer circuits.

The electrical method of gas analysis is now widely employed, but it is not so well realised that this method can be applied to the measurement of the purity of almost any gas or a single gas in a mixture. A recent improvement in recording instruments, particularly those for CO_2 percentage measurements, is a device whereby two separated records can be obtained on one chart. Previously when two CO_2 percentages were being recorded on one chart, if the values for the two points were almost equal, the chart records became close together. In the new type of instrument the records are made on separate halves of the chart, a self-contained switch alternately setting the galvanometer pointer to a new zero, the zero deflection necessary for the set up to zero being produced by a thermo-junction device included in the circuit. The two records are thus obtained on separate portions of the chart with consequent ease in reading the records.

Dissolved Oxygen Recorders

Much attention has been given to the problem of preventing the corrosion of boiler tubes, and it is well-known that the presence of oxygen in solutions in boiler feed water is the main cause De-aerating plants have been designed to reduce the concentration of dissolved oxygen and the Cambridge dissolved oxygen recorder has been evolved to check the operations of this equipment. A sample of the feed water is cooled and brought into contact with hydrogen gas generated in an electrolytic cell The sample gives up some of its oxygen which forms a mixture with the hydrogen, and passes to two of the cells of a katharometer type electrical gas analyser the remaining two cells containing pure hydrogen. The indicating or recording galvanometer connected to the katharometer provides accurate indications of the percentage of dissolved oxygen present in the feed water and if this exceeds a certain value, immediate steps can be taken to correct the operation of the de-aerating plant.

Temperature Control

The Cambridge Instrument Co., Ltd., have recently introduced a direct deflectional regulator suitable for controlling temperatures up to 1,700° C. to within an accuracy of ± 0.1 per cent. of full scale reading. One pointer indicates the temperature at any moment, whilst a second pointer determines the point of control; any deviation of the indicating pointer from the control point makes or breaks a circuit cable of carrying up to 30 amps. at 250 volts by a mercury switch. This switch may be inserted in the feeder circuit and thus affect control of the energising current.

Another new instrument of similar accuracy and range to this direct deflectional regulator is a modification of the Cambridge non-indicating potentiometric controller, whereby one instrument can be used to control three ovens or furnaces

The Needle Thermo-couple.

(or three different zones in one) at three different temperatures, thus effecting a considerable economy, and uniformity of control in large ovens or furnaces. The three-zone controller connects the instrument in turn to each of the three zones being controlled.

Contact thermocouples have now been designed for numerous special applications, one of the latest designs being in the form of a needle which can be interted into materials in a semi-plastic state for accurate determination of the internal temperature. The couple is used in conjunction with a hand-type indicator, the whole outfit being compact and portable.

Meters for the Measurement of Gas

Two Accurate Installations

THE many uses that coal gas is now being put to in chemical works, for instance, steam raising, furnace firing, the heating of drying ovens, etc., emphasises the need for accurate means of measurement, in order that a careful check can be kept of the cost of production when trading in a highly competitive market. Until recently the chemical engineer or works engineer responsible for this equipment had to make a decision between the following types of meter for measuring the large volumes of gas he needed:—

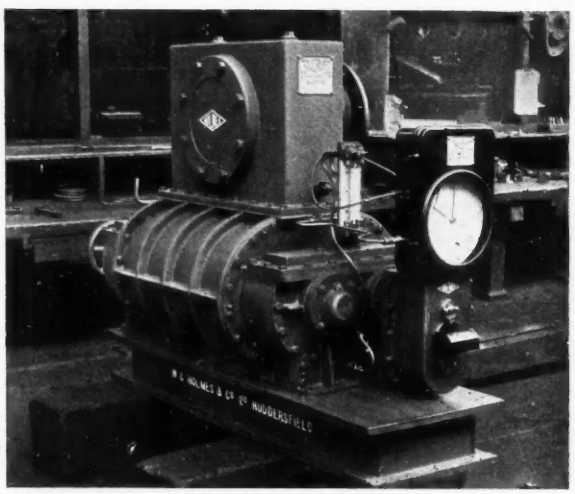
(1) The revolving drum type of meter, which depends upon the correct adjustment of the water level for its accuracy. Whilst this type of meter was very reliable, its disadvantages were that it occupied a large floor space, and needed expensive foundations, together with the fact of having to keep the meter house at a temperature above freezing point during the winter months.

(2) The Thorpe rotary type meter, which is so arranged that the flow of gas turns multiple veins placed in the gas stream. This meter has the advantage of being compact, but when deposits form on the veins, or the bearings become stiff, the readings obtained are not very reliable.

(3) The Thomas electric meter which warms the gas up 2° F. by the use of an electric heating element, and measures the quantity of energy used, so that a measure of electrical energy required to warm the gas is a measure of the quantity of gas passing. This meter is extremely accurate, and will work under comparatively violent pulsating flows, but the initial cost and maintenance are rather high.

(4) The high capacity diaphragm type of meter for throughputs of up to 10,600 cu. ft. per hour. Due to the light tin case, and the large leather diaphragms, however, these meters are liable to have a relatively short life when placed in a chemical works.

In addition to the foregoing there are several types of inferential meter working on the orifice principle.



Holmes-Connersville Meter with normal capacity of 63,000 cu. ft. per hour, fitted with Pressure, Volume, Temperature and Time Recording Instrument.

A meter which has come to the fore in recent years, for efficient and convenient measurement of large volumes of gas, such as coke-oven gas, clean blast furnace gas, carburetted water gas, town's gas, hydrogen, cleaned flue gases, and other gases including air, is the Holmes-Connersville patent positive displacement gas meter, made by W. C. Holmes and Co., Ltd. Essentially the principle of this meter is that of a much modified "Roots" blower, consisting of the use of two cast iron impellers of special shape, which always inter-engage with one another, without actually touching, being fixed on separate parallel shafts, connected by gearing at each end, and are driven round by the gas pressure, rotating in opposite directions at a speed corresponding to the flow of gas through the meter. The arrangement is contained within an outer cast iron casing, provided with heavy ribs, with the inner surface of which the impellers constantly inter-engage, as well as with each other.

The workmanship of this meter is of such a high grade character that the impellers have a clearance between them at all points of approximately 0.002 (two thousandths) inch; the same applies to the clearance between the impellers and the casing. The impeller shafts run on ball or roller bearings, depending on the size of the meter, resulting in negligible friction, and the design is such that four "pockets" of gas of known volume are trapped and released during each

B. M. Meter, 20,000 cu. ft. per hour capacity, with drum extracted from the casing.

revolution. The impellers are formed of true involute mathematical curves, therefore the displacement can be readily calculated. Readings are given by a counter mechanism, being the shaft revolutions expressed as gas volume, whilst a continuous record of the temperature, pressure and volume of the gas passed per hour, by means of pens on a chart can be included.

The accuracy of the Holmes-Connersville meter is extremely high, being within the limits of plus or minus 1 per cent. from one tenth to 1½ or twice the normal capacity depending on the size, and the other advantages of the design are of a striking character. For instance, the extremely small floor space, the size of the meter as compared with the old type of large gas meter, the fact that meters of this type will operate at almost any gas pressure; further, that the accuracy of the meter is independent of any variation of flow, specific gravity, or moisture content. When gas is bought by a works from the local gas company, it is necessary to have the meter installed, stamped and approved by the Board of Trade Meter Inspector.

Due to the Holmes-Connersville meter only being suitable for throughputs down to one-tenth of its normal capacity, other types of meters have to be considered to comply with the regulations laid down. The patent B.M. gas meter, another product of W. C. Holmes and Co., Ltd., operates on a most ingenious principle. It consists of an outer cylindrical mild steel plate casing, the bottom portion of which is filled with gas oil (medium petroleum fraction). Inside is a large drum of labyrinth type, light in weight, constructed of thin mild steel plate, forming three separate compartments of irregular shape. This drum is supported by an inner and outer ring, which engage the corresponding rings secured to the casing.

The drum is pivotted at the centre on a vertical gas inlet pipe, which enters the meter casing from underneath, in order to position it in the casing. The pressure of the incoming gas fills one of the three compartments, and causes the drum to revolve with a dipping action, on the same principle as a bicycle wheel, for example, with the rim always on the ground at one point, moving on a fulcrum at the centre, which is above the ground level. The result is that the drum has a continuous rotary dipping action, whilst always partly immersed in the gas oil, so that during one complete revolution, each of the three compartments is filled with gas, and emptied again into the gas space of the casing above the oil level. This gas space has an outlet pipe in the upper part of the casing, below the flat top, and the three compartments are of known volume, while the number of revolutions of the drum (each equal to three compartments) are read off on a counter mechanism direct as gas volume.

The B.M. gas meter, as will be appreciated from the earlier remarks, conforms to the Sales of Gas Acts, and is available in capacities from 3,000 to 130,000 cu. ft. per hour. It has the advantage of simplicity of design, with no sliding valves to wear, stick or leak, no leather diaphragms to deteriorate, and can be readily inspected by taking off the top cover. The use of gas oil as a sealing medium, instead of the more usual water, has a number of advantages, including preservation of the casing and the drum, and the reduction of "topping" to a minimum, *i.e.*, the addition of liquid to maintain the level, which is only necessary about once every two or three months when using gas oil. Moreover, in cold and temperate climates there is no trouble with freezing in winter.

Determining the Calorific Value of Fuels

The Mahler-Cook Bomb Calorimeter

THE introduction of the new Mahler-Cook bomb calorimeter with the self-sealing bomb of corrosion-resisting steel, improved calorimeter vessels of low heat conductivity, and motor-driven centrifugal water circulator, marks a distinct advance in the technique of the determination of the calorific value of solid and liquid fuels. The bomb calorimeter was first introduced by M. Berthelot and was used by him in a long series of memorable researches upon the heat of combustion of organic compounds; this apparatus is now considered a necessary adjunct for research in all chemical laboratories. More recently Mahler modified the bomb with a view to making it suitable for general use in determining the calorific value of fuels.

Among the advantages claimed for the new calorimeter are the following: No spanner required to make bomb joint —easily made by hand, and increase of pressure in bomb increases tightness of joint; one joint only to be made; corrosion-resisting steel—resistant to both nitric acid and dilute sulphuric; the shape of bomb inside and out admits of easy cleaning, and as there are no screw threads inside, moisture, liquid or dirt cannot be trapped.

The bomb vessel, nut and valve top are all machined from solid forgings of the most modern corrosion-resisting steel. The ignition system consists of an insulated plug of nickel chromium with quartz protection disc and external insulated terminal, nickel-chromium electrodes with slit and sliding sleeves for attaching ignition wire to electrodes, silica crucible for holding fuel, and external terminal common to bomb.

The calorimeter vessels consist of a water jacket of copper comprising an inner and outer vessel supported at bottom by a central fitting and jointed at upper end by a teak wood circle. The inner face or surface of water jacket is plated and polished to reflect heat given off by calorimeter vessel. The calorimeter vessel in which the steel bomb sits is of German silver of low heat conductivity and is chromium plated and polished externally. This calorimeter vessel is supported on three corks fitted into an ebonite ring at bottom of inner water jacket vessel, and an ebonite disc at bottom of calorimeter vessel supports and centres the bomb in an annular groove cut in the disc. The upper end of this vessel is kept concentric with water jacket enclosure by three ebonite buttons fastened to vessel, and thus there is no metallic connection between the vessels themselves or the bomb with the exterior. The teak wood ring joining the two water jacket vessels is french polished and carries on its upper surface the gun metal bracket and stainless rod to which the electromotor and swivelling bracket is fitted; an electric plug switch for connecting motor to mains, and two terminals connecting ignition system of bomb to electric supply are also fitted.

The cover to the enclosure formed by the water jacket enclosing calorimeter vessel and bomb is also of teak wood and turned down to fit into the water jacket ring, its position being fixed by two slots cut in the edge of lid and fitting over two corresponding tubes let into water jacket ring; these tubes also serve to fill water jacket and allow of the use of a thermometer for checking the temperature of water jacket. The underside of lid is fitted with a circular disc of copper chromium plated and polished, thus making practically the whole of enclosure a reflecting surface. An aluminium cage casting carrying two ball bearings in which the circulator spindle revolves is fitted to the upper or outside of lid; an aluminium pulley on spindle driven by a rubber band from a corresponding pulley on motor operating the circulator. Ebonite sleeves are provided for thermometer, flexible wire leads and circulator, and two gunmetal lifting screws are fixed to lid for lifting.

The Mahler-Cook Bomb Calorimeter.

The circulator consists of the above-mentioned aluminium cage, bearings, pulley and spindle to which is attached a circular ebonite rod carrying at its lower end a stainless steel tube reaching to bottom of calorimeter vessel. The lower end of ebonite rod is drilled at a right angle with tube and forms what is really a centrifuge circulating the water by drawing it from bottom of vessel and discharging it on top, the non-conducting ebonite between circulator tube and spindle preventing egress of heat to and ingress of heat from the exterior.

Ironac Metal Acid-Resisting Plant

Some Recent Developments

NEW developments in pumps and pumping equipment to deal with acids, particularly sulphuric and nitric acids and sulphate liquors, are reported by Haughton's Metallic Co., Ltd. Fig. 1 shows a glandless plunger pump constructed in Ironac acid-resisting iron, for delivering nitric acid to a height of 130 ft. in an explosives works abroad. This pump is of very substantial construction and build. All the parts in contact with the acid are made of Ironac, and the valves are so arranged that the parts may easily be disconnected for examination. The essential feature in construction with such pumps is that whilst working under pressure they should show no leakage at the plunger; they are provided with no glands and require no gland packing. They are so constructed as to be practically fool-proof and to work without the attention of skilled mechanics.

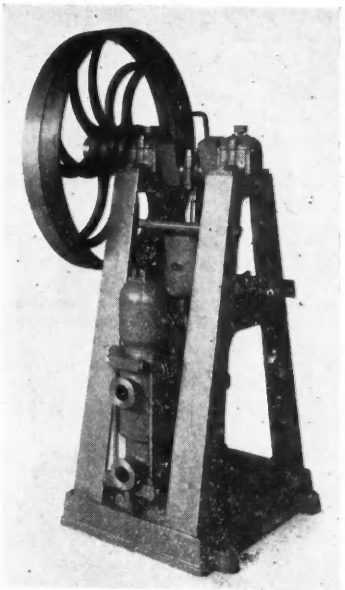


Fig. 1.—Glandless Plunger Pump constructed in Ironac Acid-Resisting Iron for pumping nitric acid in an explosives works abroad.

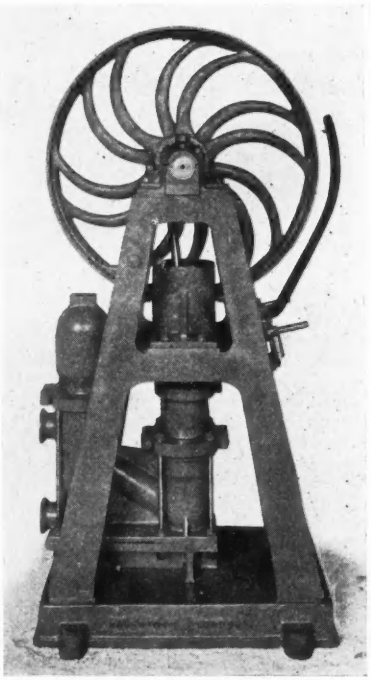


Fig. 2.—Pump for lifting sulphuric acid to a height of 73 ft.

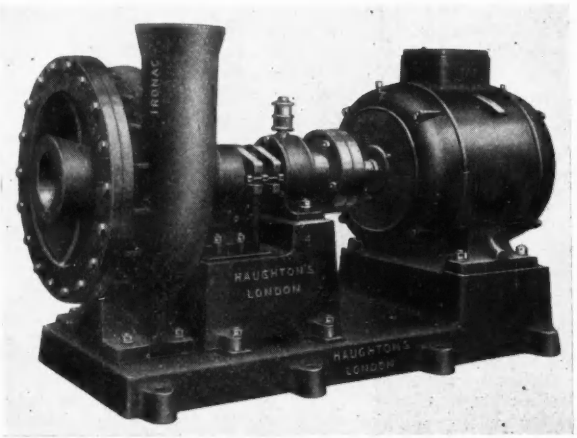


Fig. 3.—New Model Ironac Pump for Sulphuric Acid.

Fig. 2 shows a 2-inch pump for lifting sulphuric acid to a height of 75 ft. Again it will be observed that the pump is glandless, is provided with a very solid "A" type framework and with substantial cylindrical sleeve guide for the plunger.

This pump is giving great satisfaction at a chemical works in the London area, in a position where leakage or gland trouble would be a most serious objection. Pumps of this type and design bid fair to have a considerable future.

Turning to the matter of centrifugal pumps, Fig. 3 shows one of the new model Ironac acid-resisting iron pumps, designed for pumping sulphuric acid and arranged for an output of 350 gal. per minute to a head of 100 ft. This pumping unit is direct coupled to an A.C. electric motor running at 1,440 r.p.m. It is very compact and so arranged that there is practically nothing to get out of order or give trouble. The shaft is carried through ball bearings and a flexible coupling to the driving unit. The particular type illustrated is arranged with a gland, but they are also provided glandless if preferred. Pump is shown without the connecting flanges for suction and delivery ends; these are as loose flanges of cast steel arranged for bolting to British standard pipe flanges. These electric-driven pumping sets for acid of this new design are now much in demand and a number of such sets have been supplied to chemical works during the year both for sulphuric and for nitric acids.

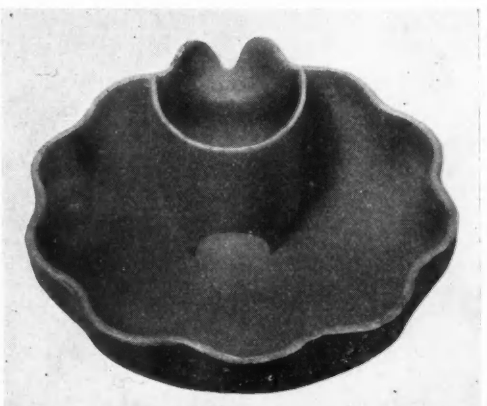


Fig 4.—Improved design of Cascade Basin.

In connection with the concentration of sulphuric acid, Ironac concentrating vessels for the cascade process are still

largely being used, not only in this country but in various places abroad.

Fig. 4 shows the improved design of cascade basin with corrugated edges allowing of free expansion of the metal whilst in operation under heat. It is found that vessels with corrugations of this type are found to present less difficulty with priming and splashing should the liquor reach boiling point.

It will be observed that a curtain or partition is cast on the inner side of the Ironac concentration vessel in such a manner that the acid overflowing through the lip of vessel is collected only from the bottom of each successive vessel so that only stronger and hotter acid is discharged through the cascade from the successive basins. Fig. 5 shows the method of corrugations in these vessels; it illustrates an Ironac basin without the dividing curtain. Equipment of this kind is somewhat unique and has been much appreciated at some of the Continental acid works and in the East, particularly where fuel costs have to be considered together with the largest possible output combined with economy of fuel in concentration.

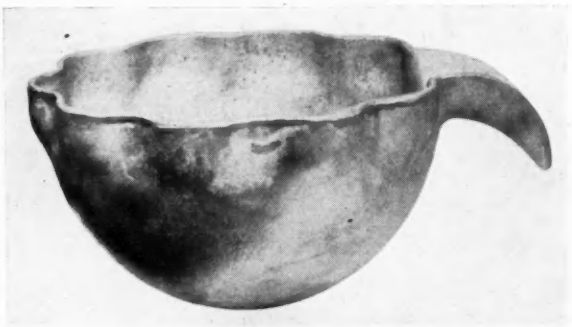


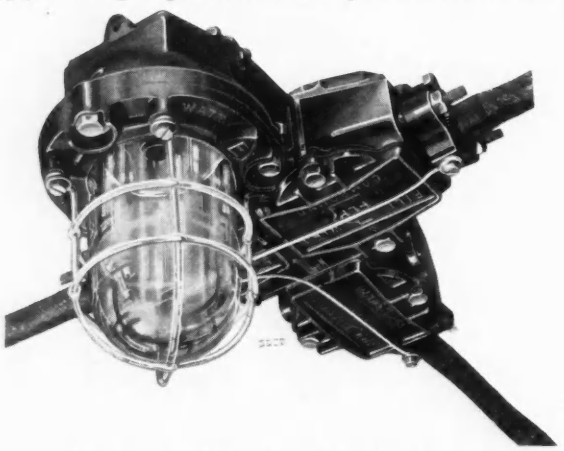
Fig. 5.—Ironac Basin, showing method of corrugation.

Flameproof Lighting Equipment

Cable Couplings and Lanterns

ELLISON cable end couplings and lanterns are "self-contained units, each complete in itself," and are designed for use in any industry where the atmosphere may become charged with an inflammable or explosive mixture. They have passed the stringent tests applied by the Mines Department Testing Station, at Buxton, to apparatus for use in methane, acetone and petroleum vapour. In collieries they may be used for roadway lighting within the limits permitted under the Coal Mines General Regulations (Lighting), 1934. They will accommodate two- or three-core single-wire armoured cables up to 7/.044 sq. in. in size and a maximum diameter under armour of 11/16 in.

They will carry 15 amperes at 230 volts, but it should be noted that the Coal Mines General Regulation (Lighting), 1934, limits lighting circuits to 10 amperes at not more than



Three-way Cable Coupling with Lantern.

125 volts. Each cable end coupling has three terminals, permitting the use of 3-core cable for any form of distribution using three wires.

When two-wire distribution is used it is sometimes desirable to use a third wire to permit the circuit to be fed from one pole at one end and the other pole at the other end. This ensures that the voltage at the lamp terminals is more constant than it would be if the same circuit were fed from both poles at one end only. As with the larger Ellison cable end couplings, the ends of cables may be connected and sealed before taking the cable to site. Much time and labour are thus saved, since two pieces of cable can be joined simply by bolting end couplings together, bridging with links and fitting a cover.

The flameproof lantern has a body so shaped that it may be bolted to a single end or two- or three-way assemblies. Two lanterns may be bolted to a straight-through coupling, one at either side. Copper links connect the terminals of the lanterns with the terminals of the couplings in the same manner as that in which the couplings are connected together, and the terminal covers will fit any arrangement of couplings or couplings and lanterns. The lantern will take a 40-watt or 60-watt bayonet cap lamp. The heat-resisting well glass is of special quality and cold water can be poured on a hot glass without causing damage. After being cemented into a bezel, each glass is tested hydraulically with an internal pressure of 80 lb. per square inch.

The strain imposed by this test is much more severe than any which could be imposed by any internal explosion in the glass. A sturdy wire guard is fastened to the bezel to protect the well glass. The bezel is made of brass, so that rust marks, which would obscure the light, will not form on the glass. All assemblies may be slung or fastened to ceiling, wall or pit prop.

Scrubbing and Distilling Towers

Increased Use of Ring Packing

THE steadily increasing adoption of ring-filled towers for scrubbing and distilling purposes is calling for a closer study of the conditions under which they are employed. The Hydronyl Syndicate, Ltd., who have had over 20 years' experience of these unit operations for a wide range of purposes, have accumulated a large collection of data from a great variety of plants in which their Lessing rings and plain rings are employed. Their technical department has investigated the effects of size and arrangement of rings on the operating conditions, the distribution and rate of liquor and gas flow, the uniformity of irrigation and the wall effect of towers, and the pressure drop set up by varying the individual factors.

They are therefore able to advise prospective customers on the design of scrubbing and distilling equipment, and, thanks to the collaboration of a number of the users of their contact rings, they are also in a position to confirm theoretical and experimental results by actual plant experience.

It is gratifying to note that the performance of ring-packed towers, which in the past had to be designed more or less empirically, can now be calculated and predicted on a mathematical basis. The field of application in the various branches of the chemical industry is constantly being widened by the manufacture of new types of rings made from material resistant to specific reagents. These can now be supplied in sizes ranging from 4 inch to ⅛ inch, in all metals, stoneware, white stoneware, porcelain and carbon, and should therefore meet the requirements of practically all processes in which intimate contact between gases or vapours and liquids is desired.

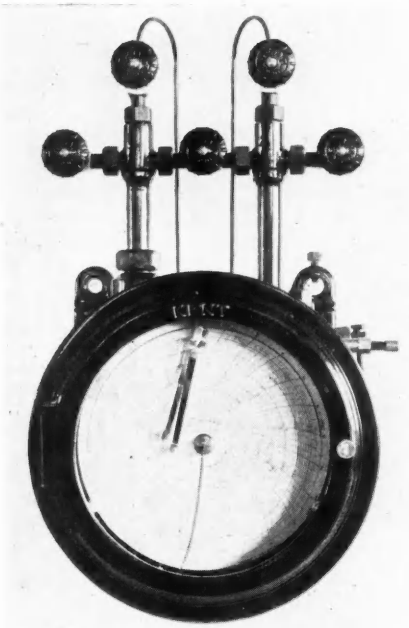
The Measurement of Fluid Flow

An Improved Meter of British Manufacture

AFTER a careful study of the existing conditions under which meters have had to function in many different countries, George Kent, Ltd., have found it possible to introduce a number of improvements in their latest design. The new KM meter is a flow meter for all fluids—water, steam, air, oil or gas—under all conditions and is based on the actual requirements of engineers in charge of all types of industrial plant.

In the development of this new design accuracy has been the main objective. George Kent, Ltd., have always followed the practice of stating the accuracy of a flow meter as being that of the complete installation of differential pressure producer and the recorder combined. In order to avoid misunderstandings and disappointments it is most essential that this should be made clear, as the accuracy of the recorder alone would be of no value to a customer if the orifice or venturi tube were not equally efficient. The overall accuracy of the KM meter is guaranteed to be within plus or minus 2 per cent. at all flows down to one-half of the range and to plus or minus 4 per cent. down to one-sixth. The recording meter will register accurately down to one-eighth of the maximum flow for which it is supplied.

Up-to-date calibration methods ensure that the actual performance is always well within the guaranteed figure. The skilled men in charge of the calibration of these recorders know that unless the meter is far more accurate than the guarantee when being tested in the shops, it will not live up to its reputation after years of service under conditions which may be very far from ideal. To ensure that absolute freedom



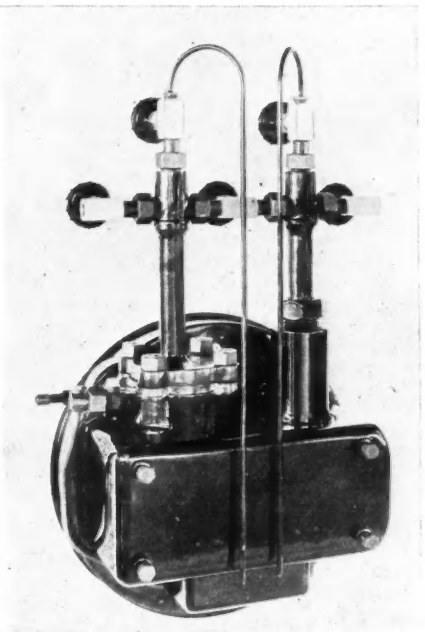
K.M. Type Flow Recorder for Fluids.

and balance have been obtained in the new design, special tests were carried out to ascertain what the lag of the pen arm would be on a radius 50 times greater than the pen radius.

The new KM meter, with its redesigned gland, larger and perfectly proportioned float and float chamber and well balanced link mechanism, had a lag of less than one-sixteenth of an inch at 25 ft. test radius, which amounts, if translated into pen movement on the chart, amounts to less than one-sixth of the width of the printed flow lines! A meter which can give such a performance in this scientific test must respond in practice to the very smallest fluctuations of flow and differential pressure.

The clock mechanism, the pressure recording mechanism, the interchangeable mercury chamber, the gland, the mercury draining and filling plugs; in fact, every part of the meter is easily reached from the front without removing the casing from its mounting. To remove the totally-enclosed clock, for example, it is only necessary to unscrew by hand four knurled bolts. The pressure attachment can easily be added to a meter which does not already possess one, or can easily be replaced by another precalibrated unit if it is desired to change the range on an existing pressure recording meter.

The draining of the mercury is an easy job: a ball drain valve is provided at the lowest point of the U-tube and a detachable portion of the actual meter casing forms a clean sump in which the mercury can be safely collected. It is, therefore, not necessary to find or provide another vessel to contain it. Another source of annoyance in the past has been



Rear view of the K.M. Type Flow Recorder.

the inability of joint rings to withstand mercury, pressure, temperature and other service conditions. The original KM, which in 1928 was already in advance of its contemporaries, had fourteen non-metal joints; the new KM meter has only two such joints, neither of which are under mercury. As the mercury chambers of these meters are made suitable for a maximum working pressure of 1,000 lb. per sq. in. and are tested to twice that amount, it will be seen that these joints can no longer be considered a weakness.

The meter is made proof against overload or reversal of differential pressure by all steel check valves placed in both legs of the mercury U-tube. The control head is part of the meter and not an assembly of valves and standard pipe fittings. The three control valves, upstream, downstream and equaliser, and the two air vent valves are identical and are entirely made of stainless steel. They are provided with spherical unions to ensure perfect alignment of the control head. The appearance of the meter is, therefore, not spoilt as is so often the case by the controls.

A great deal of attention has also been paid to the production of suitable charts which owing to the extremely adaptable design of the new meter can now be supplied for right- or left-hand recording. The charts are 12 in. in diameter and have a pen travel of just over 4 in. from zero to full flow. Standard charts are available for recording "inches of differential pressure" or decimal fractions of full flow, or can be overprinted with flow units, such as gallons, pounds, cubic metres, etc., as required.

Anti-friction Metallic Packings

Advantages of Flexibility

ANTI-FRICTION metallic packings of the semi-plastic type can often be used with good effect when other forms do not give the desired results, and some difficult problems have been solved by the adoption of this type. The principle is that a bush of antifriction metal, built up from a large number of fine fibres, will always present a true and practically frictionless surface to a moving shaft or rod.

Whether used in rope form (round or square-plaited) or in rings, or even in an entirely loose form, once the packing has settled down to its work the inner face which is against the shaft becomes perfectly smooth; in fact, if the rod is removed the packing is as solid-looking as if it had been bored out, yet it remains flexible. This flexibility enables the gland to be taken up as required, and if desired after a period fresh packing can be added, there being no deterioration of the original material. In any case, there is hardly any wear on a packing when antifriction metal only is in contact with the moving part, consequently it gives in the usual circumstances an exceedingly long life.

Such a packing reduces friction to the absolute minimum. Moreover, there is nothing in it to cause wear or scoring of the shaft, which is preserved in a true and highly-polished condition, working as it does through a flexible antifrictional sleeve. The standard alloy used by the Lead Wool Co., Ltd., for their range of packings is suitable for temperatures up to 550° F., and for dealing with steam, water, oil, etc. For use in contact with some chemicals, however, any of the range can be made from a suitable metal.

Another advantage of a flexible or semi-plastic packing is that it is more adaptable. The ring form is always made accurately to size, but when one of the rope forms is used it can usually be adapted to a certain extent to overcome variations in the size of glands. This refers especially to the simplest rope form made, long, loosely-twisted antifriction metal fibres, lubricated, two or more of which ropes can be put together to fill a larger gland. A still looser form consists of ribbons of metal (fine or coarse according to requirements) which can be made into a loose rope when taken from the tin and will pack any size of stuffing box. Of the length forms, the most resilient is the square-plaited "Silver Thread" packing, provided with a sofe core (of lubricated hemp for hydraulic work, or of asbestos for steam). Rings can also be made from this material if desired, instead of from the metal fibres only (which produces a stiffer packing).

Artificial Lighting in the Works

A Tendency Towards Increased Intensity

IN spite of the average 4 to 5 ft. candles recommended by the Home Office as being the satisfactory minimum for fine or very fine work respectively, there seems to be a growing tendency to-day towards the use of ever-increasing light intensities. Even allowing for the fact that the intensities recommended by the Home Office are the "satisfactory minimum" and therefore doubling these figures the disparity between the resulting 8 to 10 ft. candles and the intensities now being generally recommended seem quite unaccountable—one writer in a technical journal of repute even going so far as to say 200 ft. candles is merited for some industrial purposes. Advocates of intensities of this nature argue that daylight by which the eye is intended to function may run into some thousands of foot-candles and that therefore it is only reasonable that some hundreds of foot-candles of artificial light are necessary. They seem to lose sight of the very great difference in the composition, between daylight and light artificially produced, a difference obviously not overlooked by the Home Office experts when preparing their report.

Bearing in mind that when the human eye has done its best to adapt itself to abnormally high intensities it cannot again use lower, the tendency being to require constantly increasing intensities once a comfortable limit has been passed; it is the duty of all those responsible for working conditions in factories, laboratories, etc., to insist that the lowest volume of working light commensurate with accuracy of output only is used. This will result not only in economies in current consumption but in an improvement in the health and well-being of the staff.

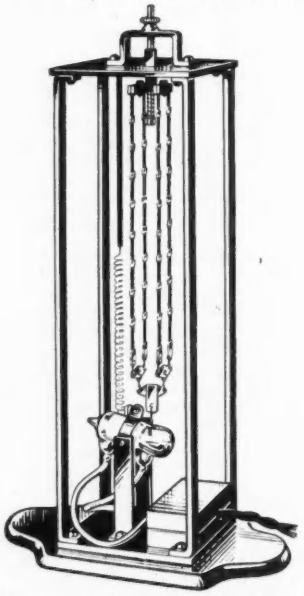
Several new forms of industrial lighting fittings have been designed by G.V.D. Illuminators, Ltd. This firm can demonstrate that satisfactory working conditions depend not so much on great intensities of light as on the manner in which it is applied. Their general policy is not to market any stock line of fittings, but to design equipment to suit the requirements of each specific job. One unit, for example, was designed to solve a lighting problem for one of the foremost artificial silk manufacturers in the country. Its purpose is to provide a practically shadowless light with controlled distribution over a large area. It has proved so satisfactory that it is being adopted generally. Where the construction of a building allows, laylights and ceiling panels are ideal for all commercial purposes. As there is no visible point source of light there is no bright spot which can strike the eye from any angle, the light obtained being perfectly evenly distributed, shadowless and free from glare; either form can, if necessary, be constructed so as to provide a corrected light (artificial daylight).

Air Humidity Control

A New Hygrostatic Mercury Switch

THE attention now given to the humidity of the air in many industrial operations has brought apparatus for automatic control into the limelight.

The new Humatagraph control, supplied by C. L. Burdick Manufacturing Co., utilises the strips from the outer fibre of the scales of ovular bracts of conifer trees. Nature has provided this substance with an extraordinary linear reaction to moisture—7½ to 10 per cent. from dry to saturation. Owing to this linear movement, and also to the absence of elasticity, this fibre can be harnessed direct to a mercury switch and avoid the necessity for relays. This means in practice the elimination of electrical contact points, always a source of trouble as well as a lot of complicated mechanism.



This hygrostatic mercury switch is operated by four strands of cone fibre working in conjunction with a phosphor bronze spring, and can be set for any desired humidity.

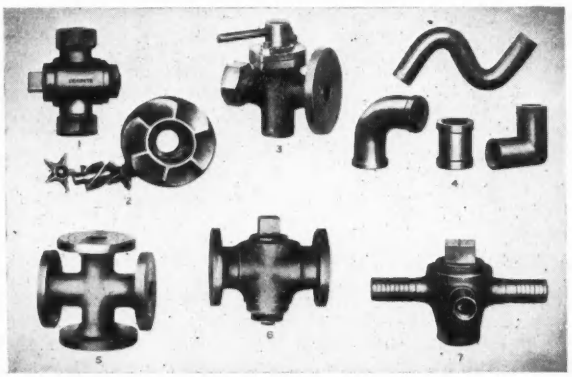
These controls are constructed in two forms; in one the relaxation of the fibre by increment of moisture allows the mercury tube to tilt and break the current, and the current is thrown in again as soon as the air becomes dry. This form may be utilised for starting and stopping a motor which is driving an air pump fan or other mechanism. In the other form the current is put on when the air becomes damp; this form is most convenient where it is desired to dry the air by heat, to prevent undue humidity, and may be used with electric heaters, or to operate a variety of heating installations by means of a solenoid magnet.

The Problem of Corrosion Resistance

Use of Ebonite and Soft Rubbers

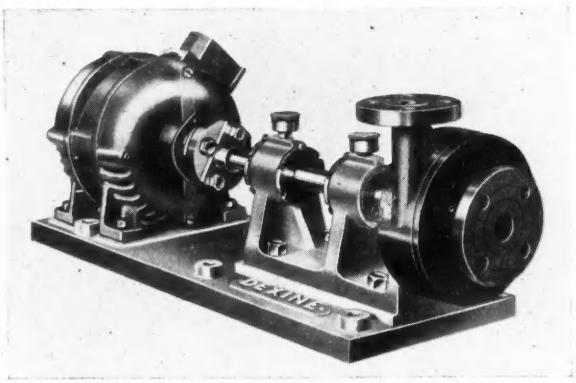
THE problems of chemical corrosion and mechanical abrasion as applied to works equipment are always in the forefront and the source of constant worry to all chemical engineers. Within recent years great improvements have been made in the construction of equipment from materials manufactured with a rubber base, either soft rubbers or ebonites, or modifications of either.

Dexine Ltd., have specialised on this problem. Their Dextonite "super ebonite" has been adapted to the corrosion problem with considerable success. This material is specially compounded with various chemical substances which on subsequent vulcanisation give a hard horn-like substance resembling ebonite, but having superior properties. By suitable



A typical group of plant accessories made of Dexonite.

compounding the material can be produced in varying grades satisfactory for use with the innumerable variety of working conditions and temperatures in common use at the present time. The material is particularly resistant to the attack of most acids and corrosive gases, and unlike most of the synthetic resin compounds, will resist the action of alkalies. It can be successfully applied to metalwork of every description, thus ensuring immunity from corrosion of such articles as storage tanks, pipes for the conveyance of corrosive liquors, expensive items of plant such as valves, pumps, and exhausters dealing with corrosive gases.



Self-contained Dexonite Centrifugal Pump.

Dextonite is much superior to the ordinary ebonite grades in tensile strength, especially at temperatures in the region of 90° C. where an ordinary ebonite is useless owing to its softening point. This property has enabled the makers to market a comprehensive range of equipment manufactured from the solid material without metal reinforcement. A complete range of pipe fittings is available, both screwed and flanged, including plug cocks, gland cocks and screw-down valves. Centrifugal pumps are being constructed without metal reinforcement, thus ensuring complete immunity from attack and so preventing the contamination of the material being pumped.

On account of its easy machining properties many articles can be manufactured in Dexonite without incurring heavy mould charges, and the makers have installed special equipment for this class of work.

The equivalent to soft rubber in known as Dexine, and can be applied either directly on to the metal or by the use of a hard rubber attachment. It is particularly suitable for the resistance of both chemical corrosion and mechanical abrasion.

New Photometric Apparatus

A Daylight Factor Gauge

THE Waldram daylight factor gauge manufactured by Everett Edgcumbe and Co., Ltd., has been devised for the rapid and accurate measurement of the direct daylight factor—the international unit of daylight illumination. It enables even an unskilled observer to determine (*a*) whether the daylight factor, at any given position in an interior subject to obstruction, is above or below some given value, (*b*) the position of iso-daylight-factor contour lines across the interior, (*c*) the actual daylight factor at any point. The Waldram gauge is extremely easy to operate since it is only necessary to count the number of squares on a specially ruled screen or "web" covered by the image of the window or windows in the room. Model I, which is intended for determining daylight factors only, is provided with three webs for positions corresponding to vertical, horizontal and inclined at 45°. Model II performs the same functions and, in addition, enables angular co-ordinates to be determined with considerable precision, and for this purpose it is mounted on trunnions.

Pocket Photometer

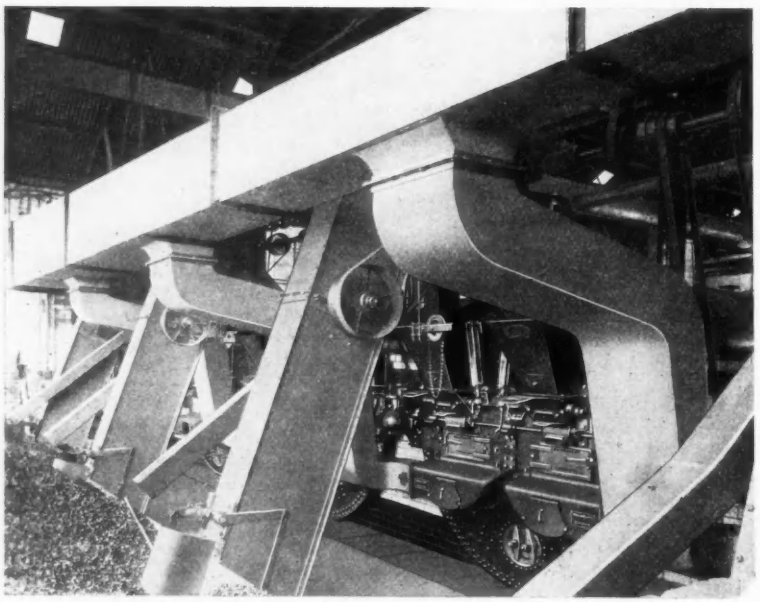
The Holophane-Edgcumbe auto-photometer is a pocket photometer for general testing and demonstration purposes. It embodies a constant photo-voltaic cell forming the test surface, together with a sensitive direct-reading illumination indicator of the moving-coil type, and can be used by anyone without previous experience. No battery, comparison lamp or other accessories are employed. It is only necessary to expose the test surface to the illumination to be measured and to read its value direct on the indicator, which is scaled in foot-candles. Model I is completely self-contained, the test surface being embodied in the indicator. It measures only 3½ in × 3 in. × 1½ in., and can readily be carried in the pocket. Model II, which also forms a single unit for transport measuring 3½ in. × 3 in. × 1½ in., embodies an indicator connected by a flexible lead to a separate test surface. The separate test surface is a valuable feature, since it enables measurements to be made in semi-inaccessible positions and, moreover, eliminates the risk of intercepting any of the light falling on the test surface. The current generated by the Holophane-Edgcumbe photo-voltaic cell is exactly proportional to the illumination and its colour sensitivity closely resembles that of the human eye, so that with changes of colour in the light the disturbing effects are, for most purposes, quite negligible. The test surface is specially treated, so that correct readings of the illumination are obtained, even if the rays of light reach it at an angle as great as 50° with the normal.

Non-Ferrous Metal Tubes for Chemical Plant

AMONGST manufacturers who have made a special study of the metal requirements of the engineering side of the chemical industry special mention may be made of the Birmingham Battery and Metal Co., Ltd. This firm has very extensive works and their activities cover the production of tubes, sheets, plates, strip and wire in copper, brass, etc. Copper tubes of all sizes and specifications are manufactured on a large scale, and the firm has made a speciality of deoxidised non-arsenical copper tubes and sheet for welding purposes. Being equipped with large rolling mills they are producing copper sheets of exceptional widths and thicknesses.

Steam Raising and Refuse Disposal

The Use of Mechanical Stokers



An installation of Meldrum Sprinkler Stokers.

MECHANICAL stokers are being employed in increasing numbers on steam raising plants in chemical works and are contributing substantially to the attainment of higher efficiencies and more economical fuel consumption. A typical installation of Meldrum mechanical stokers is shown in the accompanying illustration. Meldrum sprinkler stokers with fixed grates and fan-forced draught are fitted to five Lancashire boilers. This installation gives a saving of thirty tons of coal per week out of a weekly tonnage of 200 tons, and one of the boilers is released as a standby, which was not possible before the installation of the stokers. The efficiency has been raised from 65 to 72 per cent., and a very smoky chimney has been entirely cured.

Another development in chemical works in recent years has been the introduction of incinerators. A Meldrum installation at the works of the Chloride Electric Storage Co., Ltd., includes a water heater for the provision of hot boiler feed water. Another incinerator is in hand for Boots Pure Drug Co., Ltd., at Nottingham, in which the hot gases will be led through a Lancashire boiler for works heating. Other chemical firms using Meldrum incinerators include W. J. Bush and Co., Ltd., the South Metropolitan Gas Co., the Kent Chemical Co., and Shell Mex, Ltd.

Paint Testing Apparatus

Long-Continued Exposure Tests

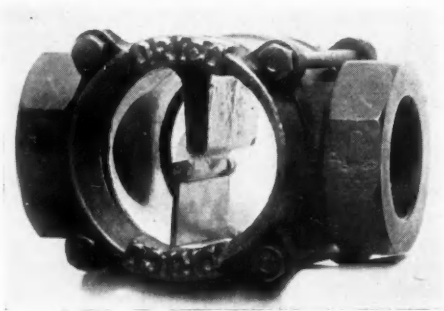
THE testing of paints as applied to structural steel works, pipe-lines, ships, bridges and in all practical protection of iron and steel, usually involves long-continued exposure tests. These present difficulty and suffer from the disadvantage that the course and progress of failure cannot readily be followed and logged, the end result only being available. The galvanic couple testing apparatus, manufactured by Kelvin, Bottomley and Baird, Ltd., Glasgow, is designed to overcome these difficulties and provide scientific tests and comparisons in which any breakdown of the paint film is progressively shown in a manner allowing the progress to be logged. The apparatus goes a step further and adds to the galvanic stress the effect of light on the samples—a source of light rich in ultra-violet radiation and similar to sunlight being employed in the apparatus.

The machine requires no electric supply to operate it and gives to users and manufacturers of paints a certain and rapid means of: (1) comparing the protective value, in regard to their resistance to corrosion, of different samples of paint accompanying a tender; (2) ensuring the osmotic resistivity of any agreed standard reference sample; (3) ensuring quickly and certainly whether bulk deliveries against a contract are equal in their resistivity to corrosion to the tender sample or other agreed standard reference sample with which the bulk delivery should coincide; (4) providing a permanent visible record of the actions of other fluids when the same grade of paint is used under different conditions; (5) forecasting and measuring the relative rates of deterioration of various paints under defined conditions; (6) permitting any paint manufacturer to compare quickly his own and other paints in a few days, as compared with more than as many months of exposure to the atmosphere on a rack or on steel girders; (7) rapidly comparing paints of identical appearance in which there is variation in the pigment or the vehicle used in its manufacture; and (8) investigating the effects of admixture of thinning and drying media to paints which have thickened during storage.

A Useful Pipe-Line Accessory

Means for Indicating Flow of Liquid

A SIMPLE device for indicating the relative rate at which liquid is flowing through a pipe-line is supplied by The Drayton Regulator and Instrument Co., Ltd. This "Floscope" comprises a cylindrical body with screwed or flanged inlet and outlet branches at right angles to the cylinder axis, closed at its two ends by stout glass discs resting on packing rings. On the inside of the cylinder a vertical weir projects into the body, to which a vane is hinged eccentrically by approximately in the horizontal central plane of the cylinder, so that



The "Floscope"

with increasing deflection of the vane by the flow the passage between the outer edge of the vane and the cylindrical body increases in area, so diminishing the flow resistance, whilst even the smallest flow causes a deflection of the vane. By weighting the vane the deflection can be made approximately proportional to the flow. For vertical pipe-lines one end of the cylinder is closed by a metal wall, through the centre of which a spindle passes with an arm on the inside resting against the vane. A spring at the outside of the wall, acting on the spindle, balances the weight of the vane and holds it horizontal until deflected by flow.

An Interim Injunction

Alleged Infringement of Trade Mark and Passing Off

IN the Vacation Court, High Court of Justice, on Wednesday, Mr. Justice Greaves Lord had before him a motion by the County Chemical Co., Ltd., against Mr. R. P. Abbott, of High Road, Tottenham, for an interim injunction to restrain infringement of trade mark and passing off.

Mr. J. L. Jones, for the plaintiffs, said his clients were manufacturers of chemical preparations, including a preparation known as "Brylcreem," of which they held the trade mark. The bottle, cap and general get up was peculiar to the plaintiffs' preparations. The plaintiffs' case was that the defendant had supplied a cream, not the plaintiffs' cream, in the plaintiffs' bottles, with similar get-up. In fact his case was that the plaintiffs' bottles had been re-filled.

Defendant appeared in person and said he purchased the bottles of cream complained of in the ordinary course of business and retailed them innocently.

His lordship: The contents of the bottles are not the same as plaintiffs'.

Defendant: That is not my fault.

His lordship said the defendant must not sell the preparation complained of.

After consultation, defendant's counsel announced that the defendant would not agree to the motion standing over, but desired to submit to an interim injunction against him.

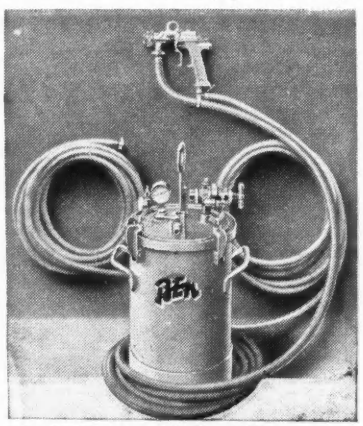
His lordship made an order accordingly with costs.

Paint Spraying Machines

A New Spray Gun

THE superiority of spray painting, both from the aspect of speed of application as well as of improvement in results over the more old-fashioned brush methods is now generally accepted. Spray painting is four to five times faster than brushing, and two coats sprayed are equal to three coats applied with a brush. No other single industrial process has so increased the output of finished products and at the same time has effected such marked economies. The rapid growth of this process in all industries is proof of its efficiency.

Of recent years spraying equipment has been greatly improved by manufacturers in this country and special outfits have been adapted to suit practically every requirement from a small set for artists' use to large multi-gun sets for painting large areas such as factories, gas holders, bridges, etc.



One of the B.E.N. Spray Combinations.

The "Handi-Spray" unit is a small, power driven, spray painting outfit which can be carried about by hand and can be run from an ordinary lighting socket. It is capable of handling cellulose lacquers, paints, distempers, etc., with results equal to any higher-priced spray plant, and is ideal for interior decoration work or for finishing manufactured articles. The B.E.N. "Pneu-Spray" has been specially designed for heavy duty work and to withstand continuous hard service. The outfit is mounted on an all-steel base with rubber-tyred wheels, and being readily portable is particularly suitable for painting contractors and decorators and for painting the interiors of works or factories. The unit is driven by a ¾ h.p. electrical motor, or a petrol engine drive can be supplied where electrical current is not available.

A new spray gun has been brought out by B.E.N. Patents, which is claimed to be particularly fast, and, in addition to handling all the usual finishing materials such as lacquers, oil paints, varnishes, etc., it is designed for spraying the new synthetic finishes and aeroplane dopes. Different painting operations call for either a round or fan-shaped spray, and these can both be obtained with the gun by rotation of the spreader cap.

Continental Chemical Notes

Holland

FURTHER SHRINKAGE IN HOME RAYON PRODUCTION is announced by the Algemeene Kunstzijde Unie, the alleged cause being excessive importations

Russia

LIQUID SULPHUR DIOXIDE in a sufficient degree of purity for use as a refrigerant is now available from the waste gases of sulphuric acid manufacture at the Czernoretsch Chemical Works.

Czecho-Slovakia

CREAM OF TARTAR AND TARTARIC ACID are now being made by the firm of J. D. Starck, who already manufacture citric acid. A new factory is reported to be under construction for this purpose in Kownau, near Falkenau.

Esthonia

ACCORDING TO REPORTS FROM REVAL, the new State Shale Fuel Works are approaching completion and will possess an annual capacity of 19,000 tons. Plans for increased oil production are also contemplated by the Esthonian Petroleum Co.

Norway

A NEW CELLULOSE-PRODUCING ENTERPRISE is to commence operations in the district of Bandsäh, where a plant with an annual output capacity of 100,000 tons is to be constructed.

THE BERGEN MUNICIPALITY is financially interested in a new rubber goods factory being constructed in the town by the firm of Ivar Bell.

Denmark

A FACTORY HAS BEEN ERECTED IN COPENHAGEN by the Lotex Scandinavian Rubber Works with the principal object of producing rubber flooring compositions.

EXTENSIVE TRIAL PLANTINGS OF OPIUM POPPY (*Papaver Somniferum*) are now being undertaken near Copenhagen by the A. S. Kemidrogen. It is eventually hoped to satisfy Scandinavian requirements of opium alkaloids.

Germany

DETAILS OF THE SEO PROCESS for photography on aluminium surfaces was given by Dr. A. Jenny and Dr. N. Budiloff in a recent lecture (published in the "Chemische Fabrik," September 18). Developing from the well-known Eloxal process for electrolytically applying corrosion-resistant coatings to aluminium, the new photographic process exploits the possibilities of impregnating the pores of the coatings with photosensitive materials. Photographs of unusual permanence are obtained, for instance, after impregnation with silver chloride, subsequent procedure being identical with that in normal photographic practice.

VARIOUS METHODS FOR UTILISING WASTE MATERIAL from formaldehyde-hardened casein plastics are suggested by a writer in the "Chemiker-Zeitung" (September 18). When ground to a fine powder the waste can be remoulded by first compressing in cold moulds before fusing by application of heat. The finely powdered waste is also an excellent filler for rubber erasers as its action upon paper is not so drastic and it can be easily coloured. For converting into a form suitable for adhesives manufacture, the waste is exposed to a current of ammonia gas when the formaldehyde is converted into hexamethylene tetramine, leaving the casein in a soluble form. The latter yields a good adhesive in admixture with 3 per cent. borax. The ammonia-treated waste is also claimed to be a rubber vulcanisation accelerator, thiourea being formed in contact with hot sulphur.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

THERE are no price changes to report in the markets for heavy chemicals, rubber chemicals, wood distillation products, coal tar products and intermediates, but there have been some slight fluctuations in pharmaceutical chemicals, essential oils and perfumery chemicals. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

LONDON.—Price still remain firm and steady. Lead acetate has advanced by £1 per ton. There is a good steady general demand. There are no changes in the coal tar products market.

MANCHESTER.—On the Manchester chemical market there is little ground for complaint as to the rate at which specifications for most of the leading heavy products are circulating and contracts are being steadily drawn against. There has been little improvement, however, during the past week in the volume of new business. It is too early as yet for any wide-scale contract buying and current bookings are mostly for small parcels for near delivery positions. From the point of view of prices conditions remain very firm and the feeling is that any modifications that come into operation in connection with new contracts are likely to be towards higher rather than lower levels. Among the by-products less easiness is in evidence and in the lighter materials, particularly, buying interest his week has continued on a more active scale.

SCOTLAND.—There has been a slight improvement in the demand for chemicals for home trade during the week, though export inquiries still remain very limited. Prices generally are firm, especially for copper and lead products, which are inclined to be dearer in sympathy with the advance in metal prices.

Price Changes

Pharmaceutical and Photographic Materials.—MENTHOL, A.B.R., recryst B.P., 13s. 3d. per lb.

Perfumery Chemicals.—ETHYL PHTHALATE, 1s. 9d. per lb.

Essential Oils.—BERGAMOT, 7s. per lb.; BOURBON GERANIUM, 23s. 6d.; CINNAMON, Ceylon, 3s. 6d.; CITRONELLA, Java, 1s. 5d.

All other prices remain unchanged.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £38 5s. to £40 5s.; pure 80%, £39 5s.; tech., 40%, £20 5s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. LONDON: Tech., 80%, £38 5s. to £40 5s.; pure 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech., 80%, £38 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—Commercial granulated, £25 10s. per ton; crystal, £26 10s.; powdered, £27 10s.; extra finely powdered, £29 10s. packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. SCOTLAND: Crystals, £26 10s.; powder, £27 10s.

ACID, CHROMIC.—10½d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—11¾d. per lb. MANCHESTER: 11¾d. to 1s. SCOTLAND: 11¾d.

ACID, CRESYLIC.—97/100%, 1s. 5d. to 1s. 6d. per gal.; 99/100%, refined, 1s. 9d. to 1s. 10d. per gal. LONDON: 98/100%, 1s. 5d. f.o.r.; dark, 1s.

ACID, FORMIC.—LONDON: £40 to £45 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £48; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £49 to £55 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. SCOTLAND: 1s. 0¼d. less 5%. MANCHESTER: 1s. 0¾d. per lb.

ALUM.—SCOTLAND: Lump potash, £8 10s. per ton ex store

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £34 per ton, c.i.f. U.K ports.

ANTIMONY SULPHIDE.—Golden, 6¾d. to 1s. 3d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £16 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered. £23 ex wharf. MANCHESTER: White powdered Cornish, £22, ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—LONDON: £10 10s. per ton. SCOTLAND: £10 10s. to £10 15s.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 to £9 5s.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots.

CADMIUM SULPHIDE.—3s. 4d. to 3s. 8d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¼d. per lb. LONDON: 4¼d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 3½d. per lb.; liquor, £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 16s. 6d. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £25 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£45 to £48 per ton.

LEAD, ACETATE.—LONDON: White, £35 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER: White, £34 10s.; brown, £32 10s.

LEAD NITRATE.—£28 to £29 per ton.

LEAD, RED.—SCOTLAND: £24 to £26 per ton less 2½%; d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £36 10s.

LITHOPONE.—LONDON: 30%, £16 to £17 per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£49 per ton d/d.

NICKEL SULPHATE.—£49 per ton d/d.

PHENOL.—6¾d. to 7¼d. per lb. to June 30, 1936.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5%, d/d U.K. Ground, 5¼d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £38.

POTASSIUM CHROMATE.—6¼d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9¾d. per lb. SCOTLAND: B.P. crystals, 10d. to 10½d. MANCHESTER: B.P., 11¾d. to 1s.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 8½d. to 8¾d. per lb.

SCOTLAND: Yellow spot, 8¼d. ex store. MANCHESTER: Yellow, 8½d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals, in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£21 10s. per ton. LONDON: £22. SCOTLAND: £20 15s.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 15s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. LONDON: 4d. per lot less 5% for spot lots and 4d. per lb. with discounts for contract quantities. MANCHESTER: 4d. per lb. basis. SCOTLAND: 4d. delivered buyer's premises with concession for contracts.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—£32 10s. per ton. SCOTLAND: 3¾d. per lb.

SODIUM CHROMATE.—4d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER: Commercial, £10 5s.; photographic, £14 10s.

SODIUM META SILICATE.—£14 per ton, d/d U.K. in cwt. bags.

SODIUM IODIDE.—B.P., 6s. per lb.

SODIUM NITRITE.—LONDON: Spot, £18 5s. to £20 5s. per ton d/d station in drums.

SODIUM PERBORATE.—10%, 9¼d. per lb. d/d in 1-cwt. drums. LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£13 per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 5½d.

SODIUM SILICATE.—140° Tw. Spot, £8 per ton. SCOTLAND: £8 10s.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d SCOTLAND: English material, £3 15s.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 2s. 6d.

SODIUM SULPHITE.—Pea crystals, spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.

SULPHUR.—£9 10s. to £9 15s. per ton. SCOTLAND: £8 to £9.

SULPHATE OF COPPER.—MANCHESTER: £14 2s. 6d. per ton f.o.b.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

VERMILION.—Pale or deep, 4s. 5d. to 4s. 7d. per lb.

ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

ZINC SULPHATE.—LONDON: £12 per ton. SCOTLAND: £10 10s.

ZINC SULPHIDE.—10d. to 11d. per lb.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 6¾d. to 7¼d. per lb.; crude, 60's, 1s. 11½d. to 2s. 2½d. per gal. MANCHESTER: Crystals, 7d. per lb.; crude, 2s. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d.

ACID, CRESYLIC.—90/100%, 1s. 8d. to 2s. 3d. per gal.; pale 98%, 1s. 5d. to 1s. 6d.; according to specification. LONDON: 98/100%, 1s. 4d.; dark, 95/97%, 1s. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s. 1d.; high boiling acid, 2s. 6d. to 3s.

BENZOL.—At works, crude, 9½d. to 10d. per gal.; standard motor 1s. 3d. to 1s. 3½d.; 90%, 1s. 4d. to 1s. 4½d.; pure, 1s. 7½d. to 1s. 8d. LONDON: Motor, 1s. 3½d. SCOTLAND: Motor, 1s. 6½d.

CREOSOTE.—B.S.I. Specification standard, 6d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4½d. f.o.r. North; 5d. London. MANCHESTER: 5¼d. to 5¾d. SCOTLAND: Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4¼d.; heavy, 4¼d. to 4½d.

NAPHTHA.—Solvent, 90/100%, 1s. 5d. to 1s. 6d. per gal.; 95/160%, 1s. 6d.; 99%, 11d. to 1s. 1d. LONDON: Solvent, 1s. 3¾d. to 1s. 4½d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

NAPHTHALENE.—Purified crystals, £10 per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s.

PYRIDINE.—90/140%, 5s. 6d. to 8s. per gal.; 90/180, 2s. 3d.

TOLUOL.—90%, 1s. 11d. to 2s. per gal.; pure, 2s. 2d.

XYLOL.—Commercial, 1s. 11d. to 2s. per gal.; pure, 2s. 1d. to 2s. 2d.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 8d. per lb.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.

BENZIDINE BASE.—Spot, 2s. 5d. per lb., 100% d/d buyer's works.

BENZIDINE HCL.—2s. 5d. per lb.

p-CRESOL 34-5° C.—1s. 9d. per lb. in ton lots.

m-CRESOL 98/100%.—1s. 11d. per lb. in ton lots.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8d. per lb.

DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—Spot, £78 15s. per ton, in paper bags.

α-NAPHTHYLAMINE.—Spot, 11½d. per ton., d/d buyer's works.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—9½d. to 11d. per lb.

p-TOLUIDINE.—1s. 11d. per lb.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 to £9. Grey, £11. Liquor, brown, 30° Tw., 8d. per gal. MANCHESTER: Brown, £9 10s.; grey £12.

ACETIC ACID, TECHNICAL, 40%.—£17 to £18 per ton.

METHYL ACETONE.—46-50%, £43 to £47 per ton.

WOOD CREOSOTE.—Unrefined, 3d. to 1s. 6d. per gal.

WOOD NAPHTHA, MISCIBLE.—2s. 6d. to 3s. 6d. per gal.; solvent, 3s. 3d. to 4s. 3d. per gal.

WOOD TAR.—£2 to £4 per ton.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Neutral quality basis 20.6% nitrogen £7 5s. per ton, less 9s. per ton for September delivery. This price of £6 16s. delivered to farmer's nearest station in 6-ton lots is the same price as for September, 1934. For delivery later than September no prices have yet been announced.

CALCIUM CYANAMIDE.—For September delivery £6 16s. 3d. per ton delivered in 4-ton lots to farmer's nearest station.

NITRO-CHALK.—The price for the new season has been announced at £7 5s. per ton delivered in 6-ton lots to farmer's nearest station—all terms and conditions the same as for the season 1934/35.

NITRATE OF SODA.—The price for this product for the 1935/36 season has been announced at £7 12s. 6d. per ton delivered in 6-ton lots to farmer's nearest station—all terms and conditions the same as for the season 1934/35.

CONCENTRATED COMPLETE AND NITROGEN PHOSPHATE FERTILISERS.—It has been announced that these products are at present obtainable at last season's prices so far as existing stocks permit, provided delivery is taken before November 30, 1935.

Latest Oil Prices

LONDON, Sept. 25.—LINSEED OIL was very firm. Spot, £28 10s. (small quantities); Oct., £26; Nov.-Dec., £26 2s. 6d.; Jan.-April, £26 7s. 6d.; May-Aug., £26 15s., naked. SOYA BEAN OIL was firm. Oriental (bulk), Oct.-Nov. shipment, £20. RAPE OIL was firm. Crude, extracted, £33; technical refined, £34 10s., naked, ex wharf. COTTON OIL was firm. Egyptian crude, £25; refined common edible, £28 15s.; deodorised, £30 15s., naked, ex mill (small lots £1 10s. extra). TURPENTINE was esier. American spot, 46s. §d. per cwt.

HULL.—LINSEED OIL, spot, quoted £26 17s. 6d. per ton; Sept. and Oct.-Dec., £26 7s. 6d.; Jan.-April, £26 12s. 6d. COTTON OIL, Egyptian, crude, spot, £25 10s.; edible, refined, spot, £27 10s.; technical, spot, £27 10s.; deodorised, £29 10s., naked. PALM KERNEL OIL, crude, f.m.q., spot, £19 10s., naked. GROUNDNUT OIL, extracted, spot, £32 10s.; deodorised, £35 10s. RAPE OIL, extracted, spot, £32; refined, £33 10s. SOYA OIL, extracted, spot, £25 10s.; deodorised, £28 10s. per ton. COD OIL, f.o.r. or f.a.s., 25s. per cwt. in barrels. CASTOR OIL, pharmaceutical, 42s. 6d. per cwt.; firsts, 37s. 6d.; seconds, 34s. 6d. TURPENTINE, American, spot, not quoted.

Inventions in the Chemical Industry

Patent Specifications and Applications

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Stabilising Glycol Ethers

GLYCOL ethers, especially the mono and dialkyl ethers of alkylene and polyalkylene 1.2 glycols, are stabilised by adding a small quantity of a hydroxyalkylamine such as triethanolamine. If aldehydes are present, the ether is preferably first treated by refluxing with acid, neutralising with alkali, and distilling under reduced pressure. In an example, the monoethyl ether of ethylene glycol is refluxed for 5 hours with a small quantity of sulphuric acid, then a slight excess of alkali is added, and the mixture is fractionated, after which 0.1 per cent. of triethanolamine is added to the purified ether. (See Specification 425,728, of Carbide and Carbon Chemicals Corporation, and H. L. Cox.)

Complete Specifications open to Public Inspection

WATER-RESISTENT BODIES consisting mainly of calcium hydroxide, production.—Mining and Industrial Works. March 12, 1934. 24929/34.

2-KETO-LÆVOGULONIC ACID, manufacture.—F. Hoffmann-La Roche and Co. March 15, 1934. 866/35.

VINYL RESIN COMPOSITIONS, and processes employing the same. Carbide and Carbon Chemicals Corporation. March 15, 1934. 2335/35.

ARSENOBENZENE-MONO-SULPHOXYLATES, manufacture.—I. G. Farbenindustrie. March 10, 1934. 5194/35.

ESTERS FROM ALCOHOLS, manufacture.—Usines de Melle. March 15, 1934. 6793/35.

CONTINUOUS PROCESS and apparatus for the elimination by physical means of sulphur contained in benzols. Soc. des Etablissements Barbet. March 10, 1934. 7185/35.

PROCESS FOR THE COMBUSTION of heavy oils, and burner for applying such process.—V. Pissart and F. Dupuis. March 14, 1934. 7251/35.

SYNTHETIC RESIN COMPOSITIONS, preparation.—H. I. Waterman and A. R. Veldman. March 14, 1934. 7935/35.

COLLOIDAL SOLUTIONS of cellulose, process for the production.—J. W. Brown. March 14, 1934. 7991/35.

Specifications Accepted with Date of Application

HEAT TREATMENT OF HYDROCARBONS and hydrocarbon mixtures, apparatus.—H. A. Brassert and Co., Ltd., and H. A. Brassert. Jan. 9, 1934. 434,948.

DYESTUFFS, stripping.—J. Y. Johnson (I. G. Farbenindustrie). March 3, 1934. 434,810.

COMPLEX METAL COMPOUNDS OF DYESTUFFS, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). March 7, 1934. 435,108.

VAT DYESTUFFS, manufacture.—I. G. Farbenindustrie. March 7, 1933. (Addition to 341,357 and 369,604.) 434,815.

VACUUM DISTILLATION OF MATERIALS yielding a solid distillate or residue.—E. W. Fawcett, J. L. McCowen, and Imperial Chemical Industries, Ltd. March 7, 1934. 435,032.

OPEN-CHAIN AND CYCLIC ETHERS, manufacture.—E. I. du Pont de Nemours and Co. March 14, 1933. 435,110.

ORGANIC DISULPHIDES, manufacture.—I. G. Farbenindustrie. March 21, 1933. 435,113.

RECOVERY OF SULPHUR DIOXIDE from gases containing same.—Metallges, A.-G. May 6, 1933. (Cognate application, 8113/34.) 435,116.

CELLULOSE ESTERS in alkaline liquors, treatment.—I. G. Farbenindustrie. March 25, 1933. 435,129.

CHROMIFEROUS DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. April 21, 1933. 434,835.

AZO DYESTUFFS containing metal, manufacture and production. J. Y. Johnson (I. G. Farbenindustrie). April 26, 1934. (Addition to 406,778.) 435,060.

CELLULOSE ESTER COMPOSITIONS particularly for moulding purposes.—Distillers Co., Ltd., H. A. Auden, H. P. Staudinger, and P. Eaglesfield. May 9, 1934. 434,970.

AID-RESISTANT SILICON-IRON CASTING, production.—Isabellen-Hutte Ges. July 5, 1933. 434,847.

ALKALI PERBORATES, production.—Naamlooze Vennootschap industrieele Maatschappij Voorheen Noury and Van Der Lande. Aug. 9, 1933. 434,991.

N-SUBSTITUTION PRODUCTS of 1.4-diaminoanthraquinones, manufacture and production.—I. G. Farbenindustrie. Sept. 19, 1933. 434,906.

CONVERSION PRODUCTS OF N-NITRAMINES of primary aromatic amines nitrated in the nucleus, manufacture.—Soc. of Chemical Industry in Basle. Jan. 27, 1934. (Cognate application, 1221/35.) 434,917.

CARBON DIOXIDE ICE, process for making.—Maschinenfabrik Surth, Zweigniederlassung der Ges. für Linde's Eismaschinen A.-G. Oct. 14, 1933. (Addition to 404,833.) 434,999.

ZINC OXIDE, process of making.—American Zinc, Lead and Smelting Co. Dec. 13, 1933. 435,005.

COARSELY CRYSTALLINE AMMONIUM SULPHATE, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). Dec. 6, 1934. 435,007.

MORDANT DYESTUFFS, manufacture.—Durand and Huguenin A.-G. Jan. 22, 1934. (Addition to 422,287.) 434,918.

ARSENATE ALUMINATE CEMENT and method for the production thereof.—Bolidens Gruvaktiebolag. Feb. 19, 1934. 435,015.

CHEMICALLY-REACTIVE ARTIFICIAL ASPHALT of unlimited stability, process for making.—Planktokoll Chemische Fabrik Ges., and J. B. Carpzow. March 26, 1935. 434,926.

DECOMPOSING BERYLLIUM MINERALS, process.—Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. April 3, 1934. 435,092.

UNSATURATED MONOHALIDES, treatment.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. April 27, 1934. 435,096.

Applications for Patents
(September 12 to 18 inclusive.)

VACUUM DISTILLATION APPARATUS.—F. E. Bancroft and Metropolitan-Vickers Electrical Co. 25710.

PURIFICATION OF GASES obtained from roasting.—E. Berl. 25771.

ACETATES, ETC., OF CELLULOSE, manufcture.—E. Barl. 25772.

ARTIFICIAL NITRO-CELLULOSE SILK, ETC., denitration.—E. Berl. 25773.

CELLULOSIC MATERIALS, treatment.—Bleachers' Association, Ltd. 25620.

GLYCOLS FROM FATTY ACIDS, production.—Bohme Fettchemie Ges. (Germany, Oct. 31, '34.) 25382.

HIGH MOLECULAR 1.2-GLYCOLS, production.—Bohme Fettchemie Ges. (Germany, Oct. 27, '34.) 25383.

CELLULOSE ESTER FILAMENTS, ETC., saponification.—British Celanese, Ltd., H. Dreyfus and R. W. Moncrieff. (March 27, '34.) 25361.

OXYGENATED ORGANIC COMPOUNDS, manufacture.—British Celanese, Ltd. (United States, Sept. 18, '34.) 25774.

CELLULOID, manufacture.—A. W. Browne. 25880.

WATER-INSOLUBLE AZO DYESTUFFS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 25695.

PRODUCING LIQUID FUELS.—A. P. A. Coreth zu Coredo. 25375.

RED CHROMATE PIGMENTS, manufacture.—Coutts and Co. and F. Johnson (I. G. Farbenindustrie). 25369.

PRODUCTS FROM CARBOHYDRATES, manufacture.—Coutts and Co. and F. Johnson (I. G. Farbenindustrie). 25549.

DYESTUFFS, manufacture.—Coutts and Co. and F. Johnson (I. G. Farbenindustrie). 25625, 25649.

PHOSPHATES, production.—H. T. Davies. 25822.

DERIVATIVES OF ANTHRAQUINONE, manufacture.—E. I. du Pont de Nemours and Co., M. S. Whelen and J. A. Wuertz. 25682.

LACTONES, manufacture.—E. I. du Pont de Nemours and Co. (United States, Sept. 29, '34.) 25818.

INERT INDUSTRIAL GASES, production.—J. Fallon. 25565.

3-ALKOXYBENZALDEHYDES, manufacture.—C. N. Geneff. (France, Sept. 14, '34.) 25469.

SULPHONIC ACIDS of 5-hydroxy-acenaphthene, manufacture.—W. W. Groves (I. G. Farbenindustrie). 25357.

2 : 6-DIMETHYLNAPHTHALENE-7-SULPHONIC ACID, manufacture.—W. W. Groves (I. G. Farbenindustrie). 25358.

NAPHTHALENE DERIVATIVES, manufacture.—W. W. Groves (I. G. Farbenindustrie). 25359.

6-AMINO-2-HYDROXYNAPHTHALENE-3-CARBOXYLIC ACID, manufacture.—W. W. Groves (I. G. Farbenindustrie). 25555.

CHLORINATING METHYL-AROMATIC COMPOUNDS, process.—W. W. Groves (I. G. Farbenindustrie). 25807.

ACID WOOL DYESTUFFS, manufacture.—I. G. Farbenindustrie. (Germany, Sept. 14, '34.) 25490, 25491.

COPPER-CONTAINING MONOAZO DYESTUFFS, manufacture.—Imperial Chemical Industries, Ltd., and F. L. Rose. 25480.

LIQUID AIR, production.—G. Maiuri. 25890.

CRACKING DISTILLATES from coal, etc., mixtures.—W. B. Mitford and J. L. Skevens. 25810.

BENZINE, process for manufacturing.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (Holland, Sept. 21, '34.) 25713.

CATALYTIC HYDROGENATION PROCESS.—Rohm and Haas Co. (United States, Oct. 11, '34.) 25884.

CELLULOSE ETHERS, preparation.—Rohm and Haas Co. (United States, Oct. 26, '34.) 25885.

UNSATURATED DIKETONES, manufacture.—Schering-Kahlbaum A.-G. (Germany, Sept. 12, '34.) 25388.

AZO DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. (Switzerland, Sept. 28, '34.) 25933.

From Week to Week

THE NOMINAL CAPITAL of Liquefied Gases, Ltd., Thames House, Millbank, S.W.1, has been increased by the addition of £19,900 in £1 ordinary shares beyond the registered capital of £100.

A. GALLENKAMP AND CO., LTD., have issued a new catalogue of laboratory apparatus for the milling, baking, grain, seed and allied trades. This catalogue has been compiled from various lists with the view of including all the requisites for general testing and the most recent methods of research.

TWO PERSONS WERE KILLED in an explosion at an ammunition factory in Melbourne on September 18. The explosion was heard two miles away. The persons killed were mixing an explosive at the factory of Nobel (Australasia), Ltd., at Deerpark, when the accident occurred. Eight rooms were wrecked.

EXTENSIONS of the Central Portland Cement Co. at Kirton-Lindsey, Lincolnshire, have been carried out at an estimated cost of £100,000. The new equipment includes a rotary kiln 310 feet in length and cement mills. Structural steelwork for the new buildings was obtained from near-by steelworks at Scunthorpe.

PILKINGTON BROTHERS, glass-makers, of St. Helens, Lancashire, who employ several thousand people, have announced an increase of wages as from September 20. The men have been given an increase of 2s. and the women workers 1s. The increase has come into force at the firm's Doncaster establishment as well as at St. Helens.

WITH REGARD TO THE CLAIM that the Falmouth Chamber of Commerce is the only body in Cornwall that can issue certificates of origin for cargoes of china clay to Germany, Mr. P. H. Housman, secretary of the St. Austell District Chamber of Commerce, points out that his chamber has been doing so for the past two years, and being duly authorised is continuing to do so under the new and more stringent regulations.

THE SIXTH ALEXANDER PEDLER LECTURE, entitled "Antarctic Exploration, Past and Present," by Commander L. C. Bernacchi F.R.G.S., has been published by the British Science Guild in pamphlet form. Copies of the lecture, price 1s. 1d., including postage, may be obtained from the Secretary, British Science Guild, 6 John Street, Adelphi, London, W.C.2.

THE IMPORT DUTIES ADVISORY COMMITTEE has received applications for an increase in the import duty on iron and steel barrels and drums of a capacity of one gallon and above, and for drawback under the second schedule to the Import Duties Act, 1932, in respect of glass syphon vases. Representations should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than October 17.

TAR POURED FROM A STILL into a furnace and caught fire, on September 19, at the works of the Lancashire Tar Distillers, Ltd., Hawthorne Road, Bootle. Workmen tackled the blaze, and one of them, William Gee, of Bootle, was burned about the face when the furnace "blew back" as water was poured on it. He was taken to the Bootle General Hospital, where his injuries were dressed and he was afterwards allowed to go home. The Bootle Fire Brigade put out the fire in half an hour by pouring water on to the furnace from two jets. Damage, which was slight, was confined to the still, but a serious fire might have occurred had the blaze spread to other stills close by.

NEGRETTI AND ZAMBRA, who are well known as makers of instruments for industrial use, have added a fourth extension to their works. It was in 1927 that the first extension was made for the manufacture of mercury-in-steel thermometers and subsequently this department was enlarged into a second extension. In 1930 a third extension was erected for the manufacture of electrical thermometers and pressure gauges of all kinds, and it is as the result of increasing demand for all types of instruments that the fourth extension has now been completed. In the assembly of certain types of electrical thermometers it is very desirable to have a dust free atmosphere, and special care has been taken to ensure cleanliness in this department. For this purpose an air conditioning plant is installed which supplies the shop with filtered air, and, if required, heated air free from dust and dirt. The test room is likewise kept dust free.

IN THE MANUFACTURE OF WATER SOLUTIONS of shellac and casein it has always been necessary to use an alkali to keep the shellac or casein dispersed. We are now informed by Glyco Products Co., Inc., New York City, that its recently developed water soluble "resin" Abopon will effectively displace alkalies in dissolving shellac and casein giving solutions which are free from alkali. Furthermore, solution can be effected at temperatures much lower than when alkalies are used. In the case of shellac, the shellac wax remains in dispersion and does not rise to the surface in the form of a scum as when alkalies are used. For coating and sizing purposes, for textiles, paper or leather, and as a priming or sealing material in the paint, varnish and lacquer industries, Abopon has many useful properties. Full information can be obtained from the manufacturers, Glyco Products Co., Inc., 949 Broadway, New York.

THE LONDON SHALLAC RESERCH BUREAU has just issued its fourth technical paper. Written by Dr. Verman, it deals with the thermal properties of lac and is supplementary to the paper on the general properties of lac which was dealt with in THE CHEMICAL AGE last month.

THE ROYAL TECHNICAL COLLEGE, GLASGOW, has just issued its Calendar for 1936. The College offers excellent facilities for studying all branches of chemistry, metallurgy and electrical engineering. Chemical engineering comprises a four years' course with special application to fuels and to design of plant.

MACLEANS, LTD., Great West Road, Brentford, have increased their nominal capital by the addition of £1,499,900 beyond the registered capital of £100. The additional capital is divided into 750,000 6 per cent. redeemable cumulative preference shares and 749,900 ordinary shares of £1 each. New articles of association were adopted on September 4.

THE MANCHESTER CHAMBER OF COMMERCE has issued its handbook for 1936. This edition contains some very interesting articles on the development of Manchester and of the town's relations with India. All Manchester's varied trades are fully discussed, and the illustrations are of a higher standard than is usually seen in a publication of this sort.

A VARNISH OVEN exploded on Wednesday at the works of Ripaults, Ltd., manufacturing engineers, King's Road, London, N.W. Flames followed the explosion. About 150 employees—mostly girls—filed out quietly into the road. A number of men on the first floor remained at work until they were advised to leave. The damage was confined to one department, and the outbreak was soon under control. Within an hour, the girls were back at work again.

THE OFFICES of Nobel Chemical Finishes, Ltd., will be transferred from Slough, to Nobel House, Buckingham Gate, London, on Monday. This removal is of more than usual interest because nine years ago this building was occupied by Nobel Industries, Ltd., which amalgamated with other large industrial concerns to form Imperial Chemical Industries, Ltd. Nobel Chemical Finishes, Ltd., was formed in 1926 as a subsidiary company in the Nobel Group, to manufacture nitro-cellulose finishes.

ARGYLL WORKS, ALEXANDRIA, DUMBARTONSHIRE, headquarters of the Scottish Amalgamated Silks, Ltd., now in liquidation, has been sold to Turner, Macfarlane and Co., solicitors, acting on behalf of the Admiralty. They will be used as an extension of the torpedo factory at Port Matilda, Greenock. The works were originally the factory of Argyll Motors, Ltd., which failed, and were used during the war as a munitions factory. They extend to over six acres and the office block is an imposing structure 600 ft. in length. Workers will be transferred from the Greenock factory to commence operations.

A FURTHER IMPROVEMENT in the china clay trade was shown in the Board of Trade returns for August. Fowey shipments were 11,000 tons above August, 1934, and Charlestown created a record with 8,842 tons. The details were as follows:—Fowey: 42,741 tons china clay, 1,759 tons china stone, 1,791 tons ball clay. Par: 8,510 tons china clay, 171 tons china stone. Charlestown: 7,440 tons china clay, 1,002 tons china stone; Padstow: 1,024 tons china clay; Looe: 240 tons china clay; Plymouth: 177 tons china clay; Newham: 81 tons china clay; By rail: 3,983 tons china clay, making a total of 68,919 tons, or 64,196 tons of china clay; 2,932 tons of china stone; 1,791 tons of ball clay, compared with 63,512 tons of china clay; 3,065 tons of china stone; 3,314 tons of ball clay despatched in the previous month.

Forthcoming Events

Oct. 2.—Society of Public Analysts. "The Chemical Examination of Furs in Relation to Dermatitis. Part VI. The Identification of Vegetable and Other Dyes." H. E. Cox. "Testing for Sea Water Damage," W. M. Seaber. "The Iodimetric Titration of Tin," F. L. Okell and J. Lumsden. Burlington House, Piccadilly. 8 p.m.

Oct. 3.—Oil and Colour Chemists' Association. London Section Presidential address. G. A. Campbell, M.Sc.

Oct. 3.—Society of Chemical Industry. Bristol Section. "Some Problems in Engineering Geology." Dr. A. E. Trueman, F.G.S., Bristol University. 7.30 p.m.

Company News

American Cyanamid.—The interim consolidated income statement of American Cyanamid and subsidiaries shows operating profit for six months to June 30 last at $3,291,189 (against $2,773,972 same period last year); total income $3,607,408 (against $3,074,751); net income, $1,493,680 (against $1,066,146).

Chemical and Allied Stocks and Shares

Current Quotations

THE following table shows this week's Stock Exchange quotations of chemical and allied stocks and shares compared with those of last week. Except where otherwise shown the shares are of £1 denomination.

Name.	Sept. 24.	Sept. 17.
Anglo-Iranian Oil Co., Ltd. Ord.	60/-	60/7½
,, 8% Cum. Pref.	33/-	34/9
,, 9% Cum. Pref.	33/9	35/9
Associated Dyers and Cleaners, Ltd. Ord.	1/10½	1/10½
,, 6½% Cum. Pref.	4/0¾	4/4½
Associated Portland Cement Manufacturers, Ltd. Ord.	56/6	57/-
,, 5% Cum. Pref.	27/-	27/6
Benzol & By-Products, Ltd. 6% Cum. Part Pref.	2/6	2/6
Berger (Lewis) & Sons, Ltd. Ord.	62/6	62/6
Bleachers' Association, Ltd. Ord.	5/6	5/9
,, 5½% Cum. Pref.	9/0¾	9/4½
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	20/-	20/-
Boots Pure Drug Co., Ltd. Ord. (5/-)	47/9	48/9
Borax Consolidated, Ltd. Pfd. Ord. (£)	97/6	97/6
,, Defd. Ord.	16/9	16/9
,, 5½% Cum. Pref. (£10)	£11/5/-	£11/5/-
,, 4½% Deb. (1st Mort.) Red. (£100)	£109	£109
,, 4½% 2nd Mort. Deb. Red. (£100)	£104	£104
Bradford Dyers' Association, Ltd. Ord.	8/1⅞	8/9
,, 5% Cum. Pref.	10/7½	11/3
,, 4% 1st Mort. Perp. Deb. (£100)	£88	£88
British Celanese, Ltd. 7% 1st Cum. Pref.	24/4½	25/-
,, 7½% Part. 2nd Cum. Pref.	20/6	21/-
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	5/3	5/3
,, 4% 1st Mort. Deb. Red. (£100)	£90	£91
British Cyanides Co., Ltd. Ord. (2/-)	3/-	3/6
British Drug Houses, Ltd. Ord.	20/-	20/-
,, 5% Cum. Pref.	21/3	22/6
British Glues and Chemicals, Ltd. Ord. (4/-)	5/9	5/9
,, 8% Pref. (Cum. and Part.)	27/6	27/6
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	46/10½	47/9¾
,, 5½% Cum. Pref.	26/3	26/3
,, 4¼% First Mort. Deb. Red. (£100)	£107/10/-	£107/10/-
British Oxygen Co., Ltd. Ord.	106/3	106/3
,, 6½% Cum. Pref.	32/6	33/1½
British Portland Cement Manufacturers, Ltd. Ord.	93/9	93/9
,, 6% Cum. Pref.	29/-	30/-
Bryant & May, Ltd. Pref.	67/6	67/6
Burt, Boulton & Haywood, Ltd. Ord.	18/1½	21/3
,, 7% Cum. Pref.	27/6	27/6
,, 6% 1st Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	108/9	108/9
,, 4% 1st Mort. Deb. Red. (£100)	£96/10/-	£96/10/-
Calico Printers' Association, Ltd. Ord.	8/1½	8/1½
,, 5% Pref. (Cum.)	13/9	14/4½
Cellulose Acetate Silk Co., Ltd. Ord.	13/1½	11/10½
,, Deferred (1/-)	2/4½	2/4½
Consett Iron Co., Ltd. Ord.	10/9	10/6
,, 8% Pref.	27/6	27/6
,, 6% First Deb. stock, Red. (£100)	£106	£107
Cooper, McDougal & Robertson, Ltd. Ord.	32/6	35/-
,, 7% Cum. Pref.	28/9	30/-
Courtaulds, Ltd. Ord.	54/4½	55/-
,, 5% Cum.	26/3	26/3
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.	25/-	25/-
,, Cum. 6% Pref.	28/9	28/9
,, 6½% Cum. Pref.	30/-	30/-
,, 7½% "A" Cum. Pref.	31/10½	31/10½
Distillers Co., Ltd. Ord.	90/6	91/9
,, 6% Pref. Stock Cum.	29/6	30/6
Dorman Long & Co., Ltd. Ord.	19/9	21/-
,, Prefd. Ord.	27/6	29/6
,, 6½% Non-Cum. 1st Pref.	22/3	22/6
,, 8% Non-Cum. 2nd Pref.	19/7½	20/6
,, 4% First Mort. Perp. Deb. (£100)	£102/10/-	£102/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£105	£105

Name.	Sept. 24.	Sept. 17.
English Velvet & Cord Dyers' Association, Ltd. Ord.	5/-	5/-
,, 5% Cum. Pref.	8/9	8/9
,, 4% First Mort. Deb. Red. (£100)	£70	£71
Fison, Packard & Prentice, Ltd. Ord.	38/1½	38/1½
,, 7% Non-Cum. Pref.	31/3	31/3
,, 4½% Debs. (Reg.) Red. (£100)	£107	£107
Gas Light & Coke Co., Ord.	26/9	27/6
,, 3½% Maximum Stock (£100)	£90/10/-	£91/10/-
,, 4% Consolidated Pref. Stock (£100)	£107/10/-	£109/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£89/10/-	£92/10/-
,, 5% Deb. Stock, Red. (£100)	£116/10/-	£116/10/-
,, 4½% Red. Deb. Stock (1960-65) (£100)	£114/10/-	£114/10/-
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	13/1½	12/6
,, 7% Prefd. Ord. (10/-)	13/1½	13/1½
,, 7% Cum. Pref.	30/-	30/-
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	30/-	30/-
Imperial Chemical Industries, Ltd. Ord.	33/9	34/9
,, Deferred (10/-)	8/1½	8/4½
,, 7% Cum. Pref.	31/6	32/6
Imperial Smelting Corporation, Ltd. Ord.	14/-	14/9
,, 6½% Pref. (Cum.)	24/3	24/9
International Nickel Co. of Canada, Ltd. Cum.	$30⅜	$31¼
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd. Ord.	107/6	107/6
Lawes Chemical Manure Co., Ltd. Ord. (1/-)	6/10½	8/1½
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros., Ltd. 7% Cum. Pref.	30/-	30/6
,, 8% Cum. "A" Pref.	32/-	32/6
,, 20% Cum. Prefd. Ord.	76/10½	76/10½
,, 5% Cons. Deb. (£100)	£107	£107
,, 4% Cons. Deb. (£100)	£104	£104
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st. Debs. (Reg.)	£50	£55
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	1/6¾	1/6¾
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	39/-	40/-
,, 1st Pref. 6½% Cum.	33/1½	33/1½
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£64/10/-	£64/10/-
Reckitt & Sons, Ltd. Ord.	111/3	113/1½
,, 4½% Cum. 1st Pref.	25/-	25/-
Salt Union, Ltd. Ord.	43/9	43/9
,, Pref.	46/3	46/3
,, 4½ Deb. (£100)	£109/10/-	£109/10/-
South Metropolitan Gas Co. Ord. (£100)	£125/10/-	£127/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£108/10/-	£108/10/-
,, Perpetual 3% Deb. (£100)	£90	£90/10/-
,, 5% Red. Deb. 1950-60 (£100)	£115/10/-	£115/10/-
Staveley Coal & Iron Co., Ltd. Ord.	26/3	26/3
Stevenson & Howell, Ltd. 6½% Cum. Pref.	73/9	73/1½
Triplex Safety Glass Co., Ltd. Ord. (10/-)	28/1½	29/4½
Unilever, Ltd. Ord.	28/3	29/3
,, 7% Cum. Pref.	38/6	40/-
United Glass Bottle Manufacturers, Ltd. Ord.	33/-	33/-
,, 7½% Cum. Pref.	18/9	18/9
United Molasses Co., Ltd Ord. (6/8)	23/9	23/9
,, 6% Cum. Pref.	7/6	6/6
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	23/9	23/9
,, 7% Cum. Pref.	£101	£101
,, 6% Deb. Red. (£100)		

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

JOSEPH BOOTH AND SONS, LTD., mfrs. of bone manure, etc. (M., 28/9/35.) Reg. Sept. 14, £12,000 deb., to C. Booth, Ferrybridge, and ors.; general charge. *Nil. Apr. 29, 1935.

Satisfactions

COMMERCIAL AND INDUSTRIAL AGENCIES, LTD. (late British Artificial Silk Co., Ltd.), London, W. (M.S., 28/9/35.) Satisfaction reg. Sept. 16, £20,000 mort. and £20,000 further charge, reg. Sept. 4, 1935, by the sale of the property charged subject to said mort. and further charge.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

COLARINE CHEMICAL CO. (a firm), 10 Wharf Road, Bethnal Green, paint manufacturers. (C.C., 28/9/35.) £13 13s. 8d. Aug. 14.

London Gazette, etc.

Companies Winding-up Voluntarily

RESIDUAL COTTON SEED FIBRES, LTD. (C.W.U.V., 28/9/35.) By reason of its liabilities, September 11. S. R. Hogg, F.C.A., of River Plate House, Finsbury Circus, E.C.2, appointed as liquidator.

UNIVERSAL TEXTILES, LTD. (C.W.U.V., 28/9/35.) By special resolution September 9. H. J. Veitch, 9 Coleman Street, E.C.2, appointed by meeting of creditors as liquidator.

New Companies Registered

Angus Wood, Ltd., Rhodes Street, Walker, Newcastle-on-Tyne.—Registered September 20. Nominal capital £10,000. Manufacturers of and dealers in zinc oxide, lithophone, white lead, antimony oxide, chemicals and chemical preparations, etc. Directors: Walter Holmes, Andrew Wood, William A. Wood, Matthew H. Groves.

British Polishes, Ltd.—Registered September 19. Nominal capital £100. Manufacturers of cleaning, polishing or renovating substances or liquids, and to take over various formulas now held by Selm Scharf. Directors: Selm Scharf, 31 Sutton Court Road, Sutton; Henry A. Gibbs, and F. W. Gibbs.

Epheta Chemical Co., Ltd., Africa House, 64-78 Kingsway, W.C.2.—Registered September 9. Nominal capital £5,000. To acquire the business of producers, manufacturers and dealers in certain chemical products known as Epheta and Anfit carried on by Anglo Swiss Industries, Ltd., at Africa House, Kingsway, W.C.2, and to carry on the business of manufacturers of and dealers in boiler cleaners, scale and incrustation removers, chemicals, etc. Directors: Otto Grueger, Phillippe L. Cooper-King.

The Ruberoid Co., Ltd.—Registered September 20. Nominal capital £100. To acquire the business of the Ruberoid Co., Ltd. (which is in course of changing its name to Diorebur, Ltd.), and to carry on the business of manufacturers and merchants of roofings, dampcourses and sidings, building, sheathing, insulating and wrapping papers, decorative materials, asbestos goods, room and picture mouldings, building and deadening felts, floor coverings, varnishes, paints, colours and electrical compounds and sanitary goods and commodities used in the construction, maintenance, decoration or furnishing of buildings, motor cars and other vehicles, etc. Subscribers: G. Conrad, 103 Phyllis Avenue, New Malden, and L. G. Garland.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Canada.—A manufacturers' agent established at Montreal wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of druggist sundries. (Ref. No. 278.)

Belgium and Grand Duchy of Luxemburg.—A firm of manufacturers established at Verviers wishes to obtain the representation, on a commission or consignment basis, of United Kingdom manufacturers of chemicals for wool washers and dyes. (Ref. No. 286.)

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APPOINTMENTS VACANT

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CITY OF BRADFORD.
SEWAGE DEPARTMENT.
CHEMIST—GREASE.

APPLICATIONS are invited for the appointment of Chemist on the staff of the Sewage Works Engineer to deal exclusively with problems connected with grease research. Candidates must have had considerable experience both in the laboratory and on a works in the examination and processing of wool grease and its allied products and of the department's recovered grease of which wool grease forms the chief constituent. He must be expert in methods of distillation, in operating plants on a works scale and in carrying out all necessary tests. In addition he should have some knowledge of the soap trade. Preference will be given to men who, having the requisite experience, also possess sound ideas as to the production of new marketable commodities from this material.

The commencing salary will be £600 per annum and the successful candidate will be required to pass a medical examination and to contribute to the Corporation's Superannuation Fund.

Applications stating age, qualifications, experience and present position and accompanied by copies of not more than three testimonials should be sent to the undersigned not later than noon on 5th October, 1935, and must be endorsed "Sewage Committee, Chemist—Grease."

N. L. FLEMING, Town Clerk.

Town Hall, Bradford. 18th September, 1935.

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